SUPPLEMENT NO. 4

The Journal of the
American Leather Chemists Association

# LEATHER MAKING

*A Discussion of Practical Problems of Tanning and Leather Manufacture*

*Sponsored by the Combined Production Clubs*

DELAWARE VALLEY TANNERS' CLUB
NEW ENGLAND TANNERS' CLUB
TANNERS' PRODUCTION CLUB OF WISCONSIN

Wednesday, May 25, 1955
Swampscott, Mass.

SUPPLEMENT NO. 4

The Journal of the
American Leather Chemists Association

# LEATHER MAKING

*A Discussion of Practical Problems of Tanning and Leather Manufacture*

*Sponsored by the Combined Production Clubs*

DELAWARE VALLEY TANNERS' CLUB
NEW ENGLAND TANNERS' CLUB
TANNERS' PRODUCTION CLUB OF WISCONSIN

Wednesday, May 25, 1955
Swampscott, Mass.

**SYMPOSIUM COMMITTEE:**

C. DAVID WILSON, Chairman

Fred Rueping Leather Co., Fond du Lac, Wis.

FRANK ZEISSIG, Secretary

John R. Evans & Co., Camden, N. J.

**SUB-COMMITTEES:**

*Calfskin Division*

MR. ALFRED MUELLER
Barrett & Co., Inc., Newark, N. J.

*Side Leather*

MR. HAROLD Y. MILLER
Seton Leather Co., Newark, N. J.

*Upholstery Leather*

DR. ELL DEE COMPTON
Eagle Ottawa Leather Co., Grand Haven, Mich.

*Goat and Kid Division*

MR. LOUIS ERERA
Allied Kid Co., Specialty New Castle Div.
Wilmington, Del.

*Sheepskin Leather*

MR. CHARLES T. CARES
John Flynn & Sons, Inc., Salem, Mass.

*Sole Leather*

MR. ARTHUR N. KAY
Howes Leather Co., West Hickory, Pa.

## FOREWORD

In 1952, a new concept was introduced at the Annual Meeting of the members of the American Leather Chemists Association, namely a round table discussion covering the practical problems facing the tanner and leather manufacturer. Meetings, in prior years, had permitted the leather chemist expression in the fields of hide, leather and tanning technology but did not necessarily allow general discussion in the more practical aspects of the industry. Also, while recognizing problems peculiar to his own organization, the chemist was not always aware of the many common problems that have harassed the manufacturer of leather. The round table discussion, with its melting pot influence, has allowed the scanning of broader horizons.

That the original round table discussion, sponsored by the New England Tanners' Club, was an outstanding success is self evident. By membership demand, the round table has been increased from the original half-day discussion to the present full day session under the sponsorship of all the national leather Production Clubs. The Council of the A.L.C.A. has expressed the hope that these practical symposiums will be a continuing effort. They provide an unusual opportunity for all segments of the leather industry to meet on a common ground, where pure science, leather technology and the leather making art can be ground into a usable amalgam.

Important as the practical tanning discussions are, they fail in the main objective, that of being assimilated by the entire membership, unless the discussions are made available in printed form.

Supplement No. 4 presents the symposium on practical problems held during the 51st Annual Meeting of the Association. The success of this symposium is due to the joint Production groups, whose committee, under the chairmanship of Mr. C. David Wilson, did a yeoman's job. Council extends its sincere thanks to the Production Clubs committee, their panel and the participants in the discussion for making the practical session stimulating and worthwhile. In the coming years, may we continue to so profit.

E. S. Flinn
President A.L.C.A.

## The American Leather Chemists Association

### Wednesday Morning Session

### May 25, 1955

The panel discussion on Leather Making opened at 9:30 a.m., Mr. David Wilson presiding.

Panel Members: Mr. Louis Erera, Allied Kid Company; Mr. Alfred Mueller, American Hide and Leather Company; Mr. Charles Cares, John Flynn & Sons, Inc.; Mr. Frank Zeissig, J. R. Evans & Company; Mr. Arthur Kay, Howes Leather Company, Inc.; Mr. Harold Y. Miller, Seton Leather Company; Dr. Ell Dee Compton, Eagle-Ottawa Leather Company.

MR. DOMINIC MEO, JR. (Salem Oil & Grease Company), Chairman of the Program Committee: Without ado I want to present to you the Chairman of the Combined Production Committees handling this session.—David Wilson of Fred Rueping Leather Company. (Applause)

CHAIRMAN WILSON: Thank you, Dominic.

This is the third gathering of practical people for the purpose of discussing leather making. After last year's meeting it became apparent that this day, the third day of the Convention, is probably something that we can and should have from now on. At least that is the feeling of your counsellors and the general reaction of the industry all over the country.

I would like to start out first by saying that there have been many people who have contributed to this program who are not sitting at this table.

As you know credit should be given to the three tanners' clubs since there was obviously much work that had to go into the organization of this meeting.

That work was done by people in the background, who realize that this meeting is important and who gave us cooperation like we have never seen before.

Actually, one of the important parts of this meeting is the organization of it and the policy-making; what we should do and what we should not do.

At this time I would like to announce that there were three representatives from each of the tanners' clubs, a few of whom are here with us at the table, who put this program together:

New England Tanners' Club, Charles Cares, John Flynn & Sons; Malcolm Battles, A. C. Lawrence Leather Company; Frank Upton, American Hide and Leather Company;

Delaware Valley Club, Frank Zeissig, John R. Evans and Company; Jerome Cohen, Allied Kid Company; Robert Weldon, Seton Leather Company;

Wisconsin Production Club, Ralph D. Olson, Eagle-Ottawa Leather Company; Wendell Morris, Garden State Tanning Company; David Wilson, Fred Rueping Leather Company.

These men did a tremendous amount of work in arranging for this meeting. Policy is very important at this meeting because if we do not operate under a set of rules, we go a little haywire.

I would like to introduce the two fellows who will be handling the traveling mikes—Malcolm Battles and Ben Grota.

I think you are familiar with members of the panel, but I will introduce them.

(Chairman Wilson introduced the members of the panel.)

Our subjects today will be bating, pickling, pre-tannage and tannage.

I don't know how far we are going to get. We purposely bit off quite a lot and I don't see why we should not begin chewing right now.

One of our panelists, in preparing his outline for this program, came up with a list of facts which our panel should consider in our discussions. I am going to read them for you because I think they are important, at least for us.

Most important today, I believe, is our aims. Why do we bate? And why do we bate the way we do? I would like to request that in our discussions, as much as possible, we talk about leather qualities and not worry too much about what the leather looks like, or what it feels like at the drum or at the paddle. Let us talk about final leather qualities as much as we know how.

The method by which the process is done, of course, will be the main part of our discussion—how do you various people do it, and why you do it that way.

The control of processes will probably enter our discussions today—how much control is necessary in these processes, and where are the important points for control?

The inter-relation between the three processes we are going to talk about is probably important, although we are going to try to take them in order; but if necessary (and it will be necessary), let us talk about the balance between deliming and pickling. We will try to take them in order.

Most important and the basic reason for our meeting, is research. There are chemists and practical people in this room, and the practical people, of course, want to make it known what we need in the way of research. I think that is probably the basic reason for this program, isn't it, Dominic?

MEO: That is right, Dave.

CHAIRMAN WILSON: Although we cannot sit here and say we need "this and that" from research, we all ought to keep specific items in mind in our discussion.

I reviewed last year's meeting and I noticed that we got pretty well into bating, although it seemed that the afternoon session last year centered around acid washing mainly. I think we pretty well covered the subject of acid washing. So, I would like to have Mr. Erera start out by giving us a few comments, and perhaps provocative questions on the bating of kid skins.

MR. LOUIS ERERA (Allied Kid Company): On our kid I will tell you what we do and then throw it open to discussion. We bate overnight. We use little or no deliming. We just use a little mixed bate at night after we wash the skins for twenty minutes and heat them up. We heat them up to a temperature of between 97 and 100 to 102. The next morning we pull them. This is all we do.

On suede we have what we call a running bate—no deliming—only putting them in a little mixed bate and run them an hour and out they come.

CHAIRMAN WILSON: When do you delime, is it together with bating?

ERERA: On the suede, yes.

CHAIRMAN WILSON: Is there anybody on the panel who bates separately from deliming?

MR. FRANK ZEISSIG (John R. Evans and Company): We start off with an old bate, add some of the deliming agent, run and set alternately for about two hours. We then pull and further bate with a new bate in a fresh bath, run for a short time and rest overnight. This is similar to a certain extent to what Louis has been talking about. This bating is for glazed kid and not suede.

CHAIRMAN WILSON: What about calf, Al—does that differ much from calfskin?

MR. ALFRED MUELLER (American Hide and Leather Company): On calfskin bating, the bating is simultaneous—that is, the liming and bating is carried out at the same time.

CHAIRMAN WILSON: Is that true of side leather?

MR. HAROLD Y. MILLER (Seton Leather Company): That is generally true in side leather, too. Our particular process differs quite a bit from the classic side leather procedure in that we lime-split, the difference being that we are working with the grain split, whereas most side leather people are taking the full thickness of the skin.

The thing that might seem different is that when you bate an unsplit skin, I do not know for sure what portion of that skin you later split off in the blue. So that just how much your deliming affects the part that you finally use, I think that possibly some one in the audience could let us know about that.

In other words, we are working with just the grain and we thoroughly delime. Possibly when you have taken the whole skin, and you delime, say, one-third from each side, what does that represent—what portion of that is represented in the finished leather? Is that portion that you split off thoroughly delimed, or is it half delimed or possibly 75 per cent delimed? Could anyone answer that question?

MR. WENDELL MORRIS (Garden State Tanning Company): In the splitting, since the thickness of the side varies, the portion of underlimed layer that you cut away would vary considerably in the sides. Roughly speaking, the side might be split about through the center of the lime streak in the heavier part of the hide, but under the lime streak in the lighter part of the hide. And so you would have a grain layer which in terms of its cross-section would not be completely delimed, but would have a lime streak of varying thickness.

In some tanneries you will find a considerably greater degree of deliming to the point of almost a light pencil streak—lime left in the middle layer. In either case the lime streak is pretty well, or quite equally neutralized by the pickle.

MILLER: In any discussion of deliming, we have to keep in mind that portion that we are using, or finally using, and how it affects that portion. In bating side leather, it has been said, and it was mentioned last year, that the bating action on the grain was not of great importance because the skins were going to be buffed, most of them, anyway. I think that a good bating action is still desired whether you are going to buff or not buff. Of course, if the fibers underneath or in the grain area are to be made into true leather, we should use the full process.

CHAIRMAN WILSON: What is side leather bated for— to knock down the hair cell—is that the only purpose?

MILLER: The bating in side leather actually is two-fold. You have the bating for the grain and also the deliming. You are controlling your plumping or deplumping in bating action. In other words, you bring down your skin with your deliming to the point that you desire.

Of course, keeping in mind the balance, again, which you mentioned before, to the pickling. You cannot divorce one from the other. They have to be worked together.

The thing that I think a lot of us are thinking about, these days is controls. We have a process and we worry whether we are on the ball every day—whether we are right on the beam.

I was wondering if anyone in the audience has come up with better controls than we have?

I can mention what we do control or try to control, and possibly other people can add to it. Possibly someone on the panel here may use different controls.

As with most, we try to control the temperature, the amount of bate, the amount of deliming or penetration of that delimer by cutting the skin and testing with phenolphthalein, and also controlling the washing after the bating. The other factor being the pH of the solution in the skin, and the time that they are in the bating bath.

After the talk yesterday by Dr. Stubbings, possibly some new tools will be available to the tanner on checking the bating process. Of course that will have to be worked up a little bit, I think. I was just wondering whether the kidskin tanners do use any other type of control.

ERERA: Basically we use about the same type of controls. We try to control the wash first to a certain titration, and then we have a definite time that we bate our skins. We don't just look at the skin and say they are ready. We give the bating foreman a definite time schedule on types of skins and he has to stick to them very closely.

CHAIRMAN WILSON: Hy, you mentioned washing. How long does a side leather tanner usually wash after bating and deliming? And second, what do you do about the situation, a very practical problem, when several drums are being washed at the same time and the line pressure stops at the end? Is it the amount of water that passes through, the number of times the water passes through, or is it the time which is important?

MILLER: To be honest with you, we have the same difficulty. Actually, for proper control, I feel that the time and the volume should both be controlled, because if you have a skin and you have a time lag where you have diffusion out of the skin, then time takes over to quite a degree there. I think most of us worry at times whether we have sufficient water when we have four, five or six drums that are washing.

I think an inexpensive good volume control instrument is necessary. In our plant we are looking into it, at the present time. We do not have the answer. This is drum bating.

CHAIRMAN WILSON: Is there anybody who would like to enter this discussion from the floor?

MR. JOHN L. IVANY (A. C. Lawrence Leather Company): I would like to raise the point of defining what we mean by "control" in this case. Do we mean that we will regulate the pH, for example? Or the amount of the bate or length of washing on each individual pack, or do we mean that we record these data, observe the trend, and if necessary, make a change? I feel that this is a pertinent question.

CHAIRMAN WILSON: You are asking a classical question, too. In the strict sense of the word, what we ultimately want to do, of course is to control the quality of leather and that is, to make it good and make it uniform. And you are asking the question, is the simple recording of the data, let us say, the control charting and the preservation of the data—is that control? In my opinion, no, it is not. The word control implies that you get the data and then do something about it.

IVANY: I go along with that, but when these gentlemen talk about control, do they mean that they actually regulate the pH on each pack? Do they mean that to accomplish that, they vary the length of washing, or do they control the degree of bating by changing the amount of Oropon for each pack? Or perhaps we feel that we can make uniform leather if we settle on a definite process, record it, watch the trend and not fool around with each pack every day. This I think is the point I was trying to make.

MUELLER: I think that is a very provocative question, Mr. Ivany. I appreciate your asking it.

Let me say this to Mr. Ivany: that in our experience, this subject of when is a pack properly bated, can we set a definite time limit? As to definite pH trend and volumes and temperatures, can they be set down and actually followed?

I believe, and our experience has shown us, that you cannot say that after you have accumulated certain data that you will bate each pack to a certain point and set a time limit on it. We have tried such a procedure and I can tell you frankly, gentlemen, that the results were quite un-uniform leather from the following standpoints: the coloring was not uniform; the temper of the leather was not uniform up to the staking room.

And I think the question Ivany is going to ask later on is: who decides when a pack is properly bated? The fellow in charge of the bate, or the leather as it comes out on the sorting table? And does he then go back and record that data and try to follow that for that type of skin and the past performance of previous packs?

May I say this: that unless your pack is fairly uniform—if you have lights and heavies in a pack which you are bating, you can follow a lime streak and bating action on a light calfskin and on a heavy calfskin and as you know

definitely it will be different, so you are going to end up with a different result in the end. And unless your selection to begin with and your operations are fairly uniform, you are not bating a uniform type of leather.

As far as setting a time limit is concerned, you could not do it because of the variations within a pack. So the question is actually provocative as to who decides when a pack is properly bated.

I believe that you can only decide that by following your controls. I think that you should stick to certain pH limits, certain temperatures, and I think probably the thing that I believe should be varied the most will probably be time; and amount and percentage of bate and delimer, with small variances, are not too important.

I believe the crux of the whole problem is, who will decide when a pack is properly bated? And I do not believe, with the variability of the stock, that you can say we have got a pack of 5 to 7's coming down, or three packs of 5 to 7's coming down in the bate, and we will bate each of these packs forty-five minutes, and that is it. You won't get uniform leather in your coloring or staking operations.

If you do that you will find, within a run of leather, up on the staking line, anything from what we call the tin roof, to a soft piece of leather. And when you get that within a run, you have poor, un-uniform leather.

MILLER: Do you agree to that, Mr. Ivany?

IVANY: I do not.

Perhaps I did not make myself clear. I had no intention of starting a general discussion on bating now. I thought I might start a general discussion on controls as such, and more specifically whether or not you should make adjustments daily, on individual packs. I will grant you that with certain processes you have to regulate the time. But we all agree that bating is also a question of pH and we know how to regulate the pH—by the amount of washing beforehand, or the amount of buffer salts or deliming agents, to name some.

I use that just as an example to get a consensus of opinion as to whether or not it is desirable to make adjustments other than time, which incidentally, we do not do. Or should we just watch trends—by which I mean recorded values related to finished leather.

MR. ARTHUR N. KAY (Howes Leather Company, Inc.): When you are in business you are usually making a certain type of leather and your beam house process is geared to that. Consequently, the stock coming to bate is in a relatively uniform condition and suitable for that type of leather.

Therefore, would it not be reasonable to suppose that in the bating operation, whether a heavy or light skin, the actual enzyme action would be comparable whether the hide was thick or thin?

IVANY: Well, of course it is of paramount importance to have your packs as uniform as humanly possible both as to weight and thickness.

ZEISSIG: Has anybody else in the audience an opinion on this subject—do you have a definite formulation? Or do you leave it up to the beamhouse or bating foreman?

MR. CHARLES A. MARTIN (E. Hubschman & Sons, Inc.): The first question I would like to ask is: Hy, when you said that you have your drums all loaded and then run a water wash at the end of the line you may not have as good a flow. How do you get the skins into the drums at once? Do you hold them overnight?

MILLER: No. The point is this: we do not have quite that many at one time. We do load mechanically and they can be loaded fairly rapidly. If there were, say a ten-minute spread between the loadings and when washed, say, a half hour at the end, we would have three drums going at the same time.

MARTIN: Mr. Mueller, on the same thing, in your bating, do you have your lots ready one after another or do you hold them overnight, or any length of time before you start bating?

MUELLER: Most of them come down in sequence. We bate one pack, or we may be bating several packs at once. We have some packs that formerly were held over, but we have discontinued that practice entirely. We try and complete all the bating the same day.

MARTIN: We do essentially the same. We will bate everything that day. However, we are talking about 5 to 7's. We have a different schedule. There is just so much time they will be in there, and five or ten minutes more is not going to make much difference.

But suppose you go up and pull a skin out and think, "These are done, let's take them out,"—you might have a thin, spready skin or—well, they will not all be the same because they are different animals, and I don't care how closely you sort them.

So we are not going to make any changes at that point. It is actually set on an average. The bating time is such—well, in an hour's run, if you keep that uniform, I think you get your process balanced and you won't have to go in there and pull out and decide that this has to run fifteen or twenty minutes longer, or anything like that.

Once we have our process established we are not going to change it by just going in there unless something should come up—unless a pulley breaks or

something like that. We run one pack after the other and we do not have the water washing problem, because no two will be running together.

MUELLER: We do have a set schedule for 4 to 5, 5 to 7's and all the way up the line. There is a certain percentage of commercially prepared bate for the types of skins, and they are set for approximate time limits. However, we try to maintain certain pH's and we maintain temperature. We have all of that set down as a guide to follow. However, as I say, the final decision as to when a pack should be pulled, if you are bating on a strict time limit—past performance has shown us at the tannery that if I run 5 to 7's—or if various types of packs are run, and I say we are only going to bate them one hour's time limit with a set pH and a certain percentage of bate, if I mix those up I have non-uniform leather by not adjusting the time.

Some need two, three or five minutes more and we give them the extra time in order to get what we think is the proper point of bating.

MARTIN: You say two, three or five minutes. My only experience with that has been through a mistake—where the bate tender fell asleep on his job and they ran a good half hour longer, and we did not see any difference.

MR. CHESTER A. ROSS (The Ohio Leather Company): Mr. Mueller, did I understand you to say that you even change the amount of bate you add in case you do not like the feel of the skins as they are progressing in the bate?

MUELLER: No, the percentage of bate is determined beforehand. There are no extra additions of materials made. The materials are kept the same. The only thing we vary is the running time.

MILLER: I would like to get back to Mr. Ivany's question more or less of what is control.

I agree with him a hundred per cent, that a lot of our controls in a tannery are negative controls. They do not control anything. They just record what we did wrong.

I would rather think, and I believe you will agree with me, that controls are something that should really control and not just record figures.

As far as pH, time, flows, and so forth, we have to give ourselves limits. You cannot say that each pack will be doctored just a little bit if it is, say a tenth of a pH off.

I did not mean it that way when I said we control the pH. I think if the pH is out of bounds, that we would change it. If we wanted to bate it at eight and one-half and found the drum at ten, we would do something, but if it was supposed to be eight and one-half and it came out at eight point six, I am sure we would not do anything.

As for temperature, in our tannery we are just starting to put in adequate equipment which controls nothing, either. It just tells you what has happened. But we do have controllers—so that if you want a definite temperature in your wash water, you do get the temperature and you can record it, too, just to have a check. Also, on time of running or pH, all those things should be checked —not just a matter of record, but actually to control it.

CHAIRMAN WILSON: This thought occurs to me: how many drums in your tannery?

MILLER: We have ten tan drums.

CHAIRMAN WILSON: In a day's production, what range of variability are we talking about—what will be the highest and lowest in a day, for example?

MILLER: Ours do not vary, very often. I would say one- or two tenths of a pH. Of course, there are times when somebody goofs and forgets to put in the bate. That shows up quickly.

Of course, in a paddle bating operation, where you can look at skins continuously, you have an advantage. If you have it in a drum and it is locked up, you do not see anything until you stop and open the drum up. It is a distinct disadvantage.

CHAIRMAN WILSON: I asked that question to get an idea of the kind of variability you are talking about. It seems to me you are even closer to the precision of a pH meter and that is an example of excellent control.

I can give you a little on the opposite side of the question. Going along with Mr. Martin, and I would like to get him back into the discussion: you will find particularly in the Middlewest, and specifically at the Fred Rueping Leather Company, the general philosophy of treating all hides the same way. It is an extreme in this discussion, and I would say that in comparison to your total range of two-tenths of a pH unit, that when all kinds are treated the same way, without controls whatsoever other than using the right amount, the right time, and the right temperature—but no purposeful adjustments—in a process like that you will find the pH at the end of the bating run in 28 drums anywhere between 8.5 and 9.2—which serves to illustrate the point that purposeful control, the kind of control in which you get the information and then do something about it, probably uniforms the quality of the leather.

But again there is an economic balance to be struck, too. Perhaps we could use one of Professor Wadsworth's mathematical models which he discussed yesterday for this situation. It costs money to control, too.

MILLER: That's right. One of the things that will contribute to control in bating, is in the washing before bating. If that can be controlled, I think the amount of lime that you are working against, with your delimer is the thing that is going to control your bating.

In other words, if you leave varying amounts of lime in and around the skin, when the delimer goes in then you will have varying results.

MR. HAROLD BERNARD (G. Levor and Company): I would like to point out something along that line. I think that is one of the most important points to control a bate. Because whether you call it deliming or call it washing, it has the same effect on leather. And whether you use a well water that is constant throughout the year, where you have the same hardness and temperature, or whether you are using a reservoir or pond water, where the temperature and the hardness varies, we find that it is very difficult to put a control system down on paper and go by that as such.

We therefore have to wash, where we use pond water, two or three times as long to accomplish the same deliming effect in the winter months as we do in the summer months.

I therefore state also that the particular day in the month and year can vary. We had a warm spell here about three weeks ago and our water at home jumped away up to 65. When they told me the water was 65 I would not believe it at that time of year up where we are.

Right off, the water characteristics in regard to deliming or washing changes. And if we wash ten minutes longer, or even five minutes longer, the skin will turn rough on us and the skin will be delimed too much in the washing.

On the other hand, in the winter months we have to add a chemical delimer in order to accomplish the result of a control which I think most everybody figures at so much pH, so much strength of phenolphthalein, before they bate—which I believe is the control.

I would like to point out that this control starts and winds up, as Mr. Miller says, and it is definitely something that is very difficult to put on paper. It is very hard to say that you are going to give it so much time, so much temperature. Because either one of them will vary under certain conditions.

CHAIRMAN WILSON: Do I understand you to say that the deliming is done before the enzyme part of bating is begun?

BERNARD: To a good extent it depends on how long you wash. That is particularly true with a sulfided skin. The longer you wash— and it depends on the pH of the water. Some water run 5.6 pH or 6.5 pH and some run 7 or 7.5 pH. If you wash with a 7.5 water, you will get a different leather than with 6.5 water.

CHAIRMAN WILSON: How do you control it?

BERNARD: By time and pH test. Sometimes we may go a little beyond the point we want to, and sometimes a little less. But before we have bated the skin we take account of how strong the skin is when it goes into the bate.

CHAIRMAN WILSON: And your criterion is phenolphthalein?

BERNARD: Yes. We take a pH of the liquor, but at the point of contact, at the point of operation, we still use the old phenolphthalein method. We have made different tests for sulphide, and so forth, staying in. But this is the final analysis. The bate master and the man who does the washing, have to be a team (or else perhaps the same man)— they must work together.

We are working with sheepskin, calfskin and goatskin, and making those into glove leather, into shoe leather, bag leather, and different types of suedes and other leather.

So we have a set formula and we use three different types of bates and different makes of bate. On each type of leather we have experimented with, we have found that we like a particular bate better for that type of leather. That does not mean it is the best one, but we use that formula—a certain bate for a certain type of leather.

One bate may be a drum bate, done in a drum. Another bate may be a short bate in a paddle. Another bate may be done overnight. So that you have a range and a formula for each one.

But I do point out that a formula is no good if the washing and the control at the very start is not done properly.

ZEISSIG: Is that up to the man on the bating drum?

BERNARD: It is up to the beamhouse foreman—the bate master. (And he should be a master).

CHAIRMAN WILSON: I take it this diversified process you are talking about is all in one beamhouse under the same supervision team.

BERNARD: Yes. Some are the lime method and some are the sulphide method.

MR. C. ALLEN LAUDER (Wickett & Craig, Ltd.): Where a tighter belly is required, how much work has been done to compare dumping and refilling with cold water after bating, and washing after bating?

CHAIRMAN WILSON: Does anybody on the panel have any ideas?

ZEISSIG: Does anyone in the audience want to answer the question?

MR. ARTHUR GOETZ (Chatham, New Jersey): I think Mr. Lauder ought to answer that himself. It was at his plant that we tried that and I would like to know what the results were. (Laughter)

LAUDER: That really was a leading question. I wanted to find out how many other plants were trying that method.

I really think we do get a tighter belly as a result of dumping and refilling with cold water. It does reduce the mechanical action on the bated hide. And such reduction is bound to result in a tighter fiber.

If washing and refilling will give you a good result and you don't have to wash at all, then you might possibly find yourself free of the kind of trouble mentioned by Mr. Bernard. As he has stated, you can get roughing of the grain from your water temperature as a result of longer milling. But where you quickly drain in paddle bating and refill, a lot of that is overcome.

KAY: That is on paddle bating?

LAUDER: Yes.

KAY: Side Leather?

LAUDER: Those are sides, yes.

KAY: Do you think the cold water may have another action in stopping the enzyme action promptly rather than allowing it to continue as the skins cool off?

LAUDER: Yes, it does stop the enzyme action and also stops any further deliming. When you test for deliming and you find that you have a certain amount of lime left in your skin, if you wash after that, you are washing some of the lime out. But when you dump and refill then you have your deliming control as you see it at the end of bating.

KAY: That would be in addition to the mechanical effect you were thinking of?

LAUDER: Yes.

ZEISSIG: Do you think that some of the reason for this is the fact that your fibers are not falling as rapidly? In other words, you are not getting the depletion that you get if you did it conventionally?

LAUDER: Yes, I would think so. I think that it is also a case of the reduction of mechanical action and the slowing down of bating—at least stopping bating

very rapidly so that it does not continue on, and controlling your deliming where you want it.

CHAIRMAN WILSON: You used the term, "tightness of bellies." I take it you are talking about the looseness of flanks and so forth, and everything that goes along with that?

LAUDER: Yes.

DR. ELL DEE COMPTON (Eagle-Ottawa Leather Co.): Mr. Lauder, do you wash before bating?

LAUDER: No, we stopped that also. I wonder if Mr. Goetz could tell us something about that.

COMPTON: While Art is coming up, and before you sit down, what is the pH of the water you are washing with?

LAUDER: The pH of our water is around 5.8, or 5.7. It is Lake Ontario water.

GOETZ: Relative to Mr. Lauder's question, I have always been very much disgusted with some of the variables in tanneries and water flow is one of them. The work done with Mr. Lauder was a continuation of work done elsewhere to eliminate this variable of washing before and after bating. As to washing before bating by the batch instead of the continuous flow method: you can compensate for the lack of that lime removed by batch washing by adding more deliming agents to the bate.

A common practice for several tanners is this: after the stock is unhaired etc. it is put in water overnight. The next morning the paddle vat is drained, refilled with water, paddled twenty minutes, drained, refilled and bated. This is uniform insofar as flow of water is concerned, because the item of flow of water does not enter into the picture, and can be done in drum bating as well as paddle bating.

As to washing after bating, why we did it: again it was a matter of flow. If the stock is bated, at a temperature of 90 degrees, then why not stop right there? A quick way to stop it is to pull the plug and refill with cooler water.

The amount of lime, that is removed during the bating, will go down probably to about two-tenths, or three-tenths per cent calcium oxide, and even if you do delime to a colorless phenolphthalein pink squeeze test, as far as you can see, and there is no lime in the stock, there still is lime in the stock to the extent of about fifteen hundredths per cent calcium oxide, because at a pH of 8 you are still in the alkaline range. To get all the lime out, you would have to go down to a pH of 5, and that is a difference of close to two-tenths.

But to sum up, the matter of this method of washing was purely to eliminate the variable in the flow of water—thus eliminating a variation in matter to be removed from the stock.

MR. N. CLIFFORD BENRUD (S. B. Foot Tanning Company): We have found a very simple method of controlling both the temperature and the amount of flow. We have installed an open tank which we keep at a definite temperature and we have a pump that will pump a regular amount of water at all times. Time is then our only variable obtaining uniform amount of water for our washing, and we, at the same time, have been able to adjust the temperature at which we wish to bate.

CHAIRMAN WILSON: That must be a large tank?

BENRUD: Yes, we do have a large tank. We have a tank sufficient to take care of one half day's run.

CHAIRMAN WILSON: Is that controlled by steam coils within the tank—thermostatically controlled?

BENRUD: Not yet, but we hope to install a heat exchanger. This method has eliminated the variables that we have had in our washing operations. Prior to that we had our fatliquor drums on the same line and we did experience considerable difficulty in maintaining a constant flow of water and a uniform temperature.

CHAIRMAN WILSON: You mentioned a pump. It is under pump pressure—the washing?

BENRUD: Yes.

CHAIRMAN WILSON: Is it a piston pump, a rotary pump, or what?

BENRUD: It is a rotary pump.

MILLER: Apropos of the remarks about washing, it seems far afield but I think with both the calf and the side leather fellows, and including the goatskin people possibly, one of the things figuring in the control of the bating is fleshing. The degree of fleshing, whether a skin is very clean or still quite a bit of flesh on it, will determine how much solid lime is held in the rough underpart of the skin.

If the washing period is short, varying amount of lime can be held by skins with varying degrees of fleshiness. I think that is something that we should look into and try to control, too.

MORRIS: In this matter of control of pH of the bate, I wonder how common the practice is of having actual control of the pH? There is a considerable amount of variation. In some tanneries on side leather, after washing, they throw the bate in and run it the length of time without regard to the control of the pH, other than the fact that the deliming automatically takes it down within a certain range.

Some tanners make a practice of actually, during the bating operation, and soon after the addition of the bate, to start a control of the pH down to quite an exact limit. It is regarded that you get proper bating at the pH that you will achieve with the addition of ammonium salts which will be anywhere from 8.7 to 9.5, depending on the concentration of the load and the amount of delimer. Others consider that you get the most effective bating action down around 8.

KAY: There has been a lot of discussion, and you have entered into it, regarding the control of the pH. Is that sufficient? Since we are dealing with a buffered solution, does pH tell us all we want to know? You can have the same pH with a considerable variation in the amount of delimer. Shouldn't we measure the deliming capacity of the bate rather than the pH?

MORRIS: Depending on whether you are bating in a paddle or a drum, you may have quite a different concentration of ammonia in the bating liquor.

KAY: But within a tannery the conditions are constant—paddle or drum—within any given tannery?

MORRIS: Within any one given tannery, yes. And whether the enzyme is most efficient at a higher range than, let us say, 8.3.

KAY: This brings up a point I believe I brought up last year, and I think Dr. Pfannmuller substantiated it. We have, in commercial bating with a mixture of bating and delimer—(Dr. Stubbings' paper yesterday tended to substantiate the fact), two actions going on at the same time and they are not completely inter-related.

We have enzyme action on the one hand, which is the removal of protein matter of one sort or another. We also have the removal of lime, which is a function of the delimer.

Now, granted they do inter-relate to the extent that variation in the deliming changes the enzyme rate, possible by variations in plumping and allowing the enzyme to get in, and conversely the enzyme action allows the delimer to get in—we have in our own experiments—(sole leather of course is a little different)— but we have found it desirable, with our type of liming, to increase the delimer over the amount that is free in the commercial product. We add extra delimer.

To get an idea of what we are doing, we titrate that. We use an end point of 10.5, which is the end point for ammonium salts, and by using that technique we feel that we have got better control of our deliming, and we assume that, since we are adding a constant amount of enzyme, the enzyme action is also probably pretty well controlled.

CHAIRMAN WILSON: A vegetable tanner speaking—at this point I at least would be interested to know; does all of this discussion fit into the bating of upholstery leather, Ell Dee?

COMPTON: Last year there was quite a bit of discussion on bating of upholstery leather, and it was brought out rather strongly that in general upholstery tanners only delime. There is very little bating in many processes.

You may remember that Koerniger last year said they bated at a temperature of 68-70°F., and his comment was questioned. We paddle bate. We do wash prior to bating and use a mild acid wash. We bate about 85 degrees and try to hold it rather carefully, and with a low amount of bate—one and a half per cent.

The time cycle is one hour running, and one hour still, and then cooled by merely running in well water—brought down to 60 degrees, drained and refilled.

I was intrigued by Mr. Lauder's point of no further deliming. Because at the end of our bating period of two hours, we still have a slight but definite lime streak. Our water pH is above 7 and his pH is 5.8. We still find that the following morning—these are left in the paddle overnight—that the lime streak is gone. Perhaps the total deliming has not gone forward. But it is certainly uniform. I do feel even with a pH of 7.5 you will get some more deliming. I think that might be batted around a bit.

MR. ANDREW J. GARD (The Dow Chemical Company): What is the relationship between the fixed lime and the free lime, and its effect upon, say, enzyme action? You are tying in two different functions and actually, even this washing problem that has been brought up—I think it is tied in with the free lime and not the fixed lime of the limed stock.

CHAIRMAN WILSON: By that you mean lime which is not attached to the skin—just lime in the system?

GARD: Yes. We are all talking about washing and its relationship to reducing the pH. It appears to me that the free lime in the stock is one factor and the fixed lime another. I don't think you will have too much effect upon the latter. And it is pointed out the lime will still be about two-tenths percent at the end of deliming. Also, what is the electrolyte effect upon enzymatic action?

In other words, I want to see the results with a high electrolyte content, calcium chloride. If you have a high hardness water, that would indicate to me that enzymes should function better.

CHAIRMAN WILSON: In high electrolyte?

GARD: In a high calcium chloride system.

KAY: We have done some experimenting with bating. In the sole leather industry you more or less bate continuously—use the same paddle and put your hides in and take them out and put some more bate in, and put in another pack, and so on, throughout the day. We mark stock from a given paddle throughout the day.

As I recall we had around seven packs through that particular paddle during the day. We marked that stock from each paddle. In the finish, in the shipping room, the first pack was the worst. The second pack was better. The third pack was about the optimum, and that held until about the sixth pack. The seventh pack we felt was slightly poorer. By that I mean as to grain characteristics, smoothness, appearance, color and the general things you look for in finished leather.

In other words, I feel, myself that the calcium content probably largely does have an effect on the enzyme.

That does not take into account the possibility that the enzyme, itself, may increase in activity. It does not take into account— and we did not determine —the possibility of bacterial build-up. But we have checked that several times and there is a difference between the low calcium and the high calcium.

Whether it is the calcium, I cannot be sure but I have a feeling that the calcium does play a part, which is part of an answer to your question, it it not?

GARD: It is. But I would like to bring out a point that we are all talking about—control of pH in bating. And some people wash and some people do not. And that apparently is a factor of concentration. In other words, they carry a lot of lime in their bate and some, because of the fact that they wash before hand, wash away a lot of the free lime and get a faster deliming action, and they are tying in the fact that the lower lime brings about, say, an accelerated enzymatic action, so that they can save a little time.

That might be a point, but basically, we are trying to tie in two unrelated reactions—one deliming, fixed lime and free lime, and what its relationship is to enzymatic action—which would bring about a lot of the variables we are talking about, which I think have been loosely associated with basically the amount of lime in the stock.

KAY: The fixed lime and free lime are in equilibrium with each other. That is soluble lime.

GARD: The soluble lime—there is a soluble form of lime and then there is the insoluble, and they are both free lime and in equilibrium with each other. The fixed lime I do not think has any factor in the system at all. The only thing that is going to cause the fixed lime to become disassociated from the protein is dropping the pH or a complexing agent.

KAY: Which you do in deliming.

GARD: That ties in with what is greater—the free lime or the fixed lime. In other words, the free lime that you have in your stock and the fixed lime or the bound lime are really not dependent on each other only in so far as the capacity of the hide for binding calcium.

KAY: That is what I am trying to bring out. At least in my opinion, leaving out gross lime, insoluble lime, on the surface, your lime is in solution, or it is fixed to the protein.

The only reason it fixes to the protein is by virtue of the concentration in the external solution. If you dilute that, then some starts coming off. Otherwise you could never remove lime from hide.

I cannot quite visualize how you could have, let us say, a lime fixed to the hide and none within the hide in solution, which is what I gather you are referring to.

GARD: You have about two or three different systems: you have the soluble form, the insoluble form, and the fixed lime, too, don't you? You have all three existing simultaneously.

KAY: Insoluble within the hide?

GARD: As calcium hydroxide. I agree there would be—with $CO_2$ present you could have it as calcium carbonate.

KAY: Where would the $CO_2$ come from?

GARD: The air.

KAY: In the hide?

GARD: From the water.

KAY: How does it get into the hide?

GARD: The calcium carbonate forms by $CO_2$ neutralizing calcium hydroxide.

KAY: How do you get insoluble lime within the hide?

GARD: This is the phase we are talking about—deliming phase, where you have water which brings in $CO_2$, that is, a neutralizing action, too.

KAY: In the washing?

GARD: Yes. So I am trying to tie in—what does the calcium concentration have in relationship to the enzymatic action?

KAY: Don't you think that the insoluble lime would show up on the surface as lime blast, which is a special problem?

GARD: I do not want to get into that.

KAY: We do not normally consider lime blast as a criticism of our bating procedure. It is usually a matter that is outside of the actual bating. In other words, we do not consider lime blast—

GARD: I do not want to refer to it as that. I do not want to be drawn into that phase of it at all.

KAY: You brought it up.

GARD: No. I am talking about the fact that you can have calcium carbonate without having lime blast.

KAY: Below the surface? That is true. I do not know the answer to it. I can only toss in the observation I made.

LAUDER: I would like to further qualify the statement I made a few moments ago. When I said that when you stop mechanical action your deliming stops—now, there may be a certain degree of deliming there, but it is so little that you cannot see it. Over a period of ten to fifteen minutes you can bate by paddling, stop, stop the paddle, paddle again, and again stop your paddle. In stopping your paddle, your bating goes on but your deliming stops.

Or, shall I say, if it does delime at all, it is so little that you cannot notice it. You have to paddle, you have to use mechanical action, to get deliming.

CHAIRMAN WILSON: Mr. Salamatov.

MR. ANDREW SALAMATOV (Barrett and Company, Inc.): I think we can talk endlessly about what is being done in tanneries. Conditions everywhere are different, and if we are worth our salt, we have to adjust ourselves to different conditions.

Therefore, I think we are spreading too far afield and probably are missing our main point, which Dave stated very clearly. I would like to see if we can get

back to that principal viewpoint: why do we bate? What is the purpose?

Now, because of differences in water, climatic conditions, different beamhouse procedures—and in beamhouse procedures we can juggle—increase or decrease, put in one thing and take away another—and all of those things will sooner or later reflect themselves and they have to be somehow correlated.

This matter of correlation, I think, is the principal aim of the bating. At least I consider it that way.

In our practice, we consider bating as the leveling off of the beamhouse procedure—it is the end of the beamhouse. It is absolutely necessary that it is adjusted to such factors as soaking, time of soaking, temperature of soaking, the liming procedure, length of liming and so on, and so forth.

We are situated in a place where we have constant water conditions. We use city water, a lot of it, and certain things are so constant that they do not require any of the repetitious and endless tests.

In former days I used to believe that the phenolphthalein test is the crown of the whole thing. I do not believe it any longer. I think it is important to some extent, but we all seem to be inclined to overrate certain gadgets.

As far as controls are concerned, I say the only control which is really worth anything is the leather, itself. The leather itself, has been examined in our place after it comes off the board. We don't paste. We toggle.

So when the leather comes off the boards we examine it and there and then we decide whether it is satisfactory. If it is not satisfactory, we decide where the fault may be. And more often than not, we think that it is in the bate.

And if we find there is something that could be, in our opinion, rectified with the bate, we may go and make certain changes.

As far as day-to-day procedure is concerned, we bate the same way without any changes. We maintain very strictly a constant temperature. We maintain time. We maintain always the same amount of bate (percentage wise).

Whenever a pack goes astray before the bating, for one reason or another—mechanical breakdowns or something else— delays and so on, we would invariably make adjustment in bate and therefore, as I said, we use our bating procedure as a leveling-off procedure. And we try to control our product by modification in bating when we find it necessary. We do not do it very often, but we do it when we feel that we want to do it.

CHAIRMAN WILSON: The Fred Rueping Leather Company happens to be an advocate of that same philosophy. I am glad that viewpoint was given today.

MILLER: I would like to try and sum up a little bit on the question that Andrew brought up, of why do we bate?

After listening to the excellent paper that Dr. Stubbings gave yesterday, that within the limits of what most tanneries use in the way of time, temperature and concentration of bates, there seems to be very little difference or effect

there can be from the enzyme action other than that which would take place in that particular set of conditions.

But the major changes that take place at the bating process are the removal of lime and the deplumping that ensues. So that I think the discussion on controls this morning did point up that one fact—that our main problem in bating is controlling the deliming, which is a rather difficult thing.

CHAIRMAN WILSON: It has been fairly obvious that that has been the case. The controls seem to relate to the deliming more than the bating.

Which leads us, I believe, to another very important part of this subject, and that is, how much enzyme?

In order to get this started, I would like to call on Louis Erera, again, simply because of the fact that kidskin probably represents more enzyme than any other type of leather. I believe kidskins are bated with a lot of enzyme, is that correct, Louis?

ERERA: We do not consider it a lot. We use anywhere from 1 to 1-1/2 per cent of an enzyme and it is not a concentrated enzyme. It is a mixed bate. So we do not consider that a lot of enzyme. Of course the running time is lengthened.

As you know, the glazed kid is bated overnight and it is laying in there longer, and we feel that the action is taking place a little slower overnight, and therefore we do not need as much.

ZEISSIG: I think on kid we are a little more concerned with the grain than the calf and side leather tanner. I do not mean to imply by this that they can ignore the grain in bating, but rough grain of a goatskin requires a lot more conditioning through bating than calf or side leather.

Is Reuben Henrich in the back of the room? I would like very much to have him comment on this.

REUBEN G. HENRICH (B. D. Eisendrath Company): I would say in my experience with both goatskin and calfskin, that you definitely will bate to a greater extent with a larger amount of enzyme than you do in calfskin. But I think in both cases you are very much interested in the grain and the effect that you have on the grain. Of course in calfskin, we do not bate overnight, which a lot of them do as far as goatskin is concerned. But certainly I believe that in your goatskin you use a higher concentration of enzyme in your bating than you do in calf.

As far as the deliming action is concerned, I would say in your goatskin that you are fairly completely delimed. It depends entirely upon what you want in your finished leather, as to whether you delime completely on calf or whether you leave a slight lime streak in your stock before you bring it on to pickle. I don't know whether that answers your question.

ZEISSIG: Thank you very much.

CHAIRMAN WILSON: Reuben, why the contrast? Why is there more on kidskin than calfskin? Does one need more flattening out?

HENRICH: There is a considerable difference in your fiber structure. Certainly on a good many of your goatskins you have a rougher nature to the grain structure than on the calf. That is inherent in the skin. In order to make a nice, smooth piece of leather, as far as goatskin is concerned, especially when you are making it on some of the India type, so-called harder nature skins, you do have to bate with a fairly high concentration of enzyme and a longer time as a general rule, or much higher temperature.

Temperature, time and concentration, play a part in that and it depends on your particular conditions in the tannery, and also what has gone before as far as your beamhouse is concerned—the liming system that you use.

CHAIRMAN WILSON: It is just a tougher skin?

HENRICH: I would say yes, definitely, from my experience.

DR. H. G. TURLEY (Rohm & Haas Company): I would like to call the attention of all of you gentlemen to one rather simple fact in this talk about the different amounts of enzyme in relation to the skins. If you realize the microscopic structure of the skin, you can see the problem at once.

In a goatskin you may have as much as 85 per cent of the thickness of the skin taken up with the epidermal layer, the layer which has been called the corium minor, in histology—which John Arthur Wilson used to call the thermostat layer.

That is the layer in which you have the epidermal structure highly developed. In a calfskin this may vary from 25 to 15 per cent, in your increased weight classifications on up to kips and when you come to steer hides, may be only about 5 per cent of the total thickness.

Since the enzyme action historically has been found to be an important factor for smoothness in grain, cleanness of scud, and so on, it is not surprising to find that it has been found practically that this is related to the type of skin. That grain, I believe, is related to the percentage thickness of the epidermal layer.

Incidentally, in Stubbing's paper yesterday, when he referred to the epidermis—it may not be entirely epidermis from a grain split layer—nevertheless, I want to call attention that that is what is called scud—that mixture of things, hair remnants, itself, or lining of the glands and other elements. It is all in general called scud.

I just want to bring out that there is a big difference in the ratio of the epidermal layer to the total skin.

CHAIRMAN WILSON: Thank you Dr. Turley.

MR. PHILIP ODELL (Lincoln Tanning Corporation): It seems to me in listening to this discussion, that one of the important aspects is what kind of tannage is used. I want to ask whether leaving a lot of lime in the leather would have more effect on a straight tannage than in a formate tannage?

Will a side with a half lime streak in it, followed by straight tannage, against a side completely delimed, show more variation on a straight tannage than on a formate tannage?

CHAIRMAN WILSON: Are there any comments on that question?

Of course, Mr. Odell, you will find that especially side leather tanners are at great variance on the amount of lime to be left.

ODELL: On the calfskin, it would seem to me to be critical—the lime streak, where in formate tannage a little variance might not be so critical.

CHAIRMAN WILSON: Perhaps.

MILLER: On that point, Mr. Odell, the limiting factor I should say is the type of pickle used in both cases. If you have a piece of leather where you leave a wide lime streak and one on which you do not leave a lime streak, and you use the same pickle on both, I am sure you will have quite a difference in the skin when the hides are tanning.

But if it is compensated for, I believe you would see a lot less differences. Of course with a formate added to the tan, your buffering action will slow down the action of the lime if there is any still in the skin when the chrome does get to it.

DR. W. J. MCDERMOTT (Rohm & Haas Co.): Isn't it true that at the opening of this discussion the criterion set for the effect of bating was to be the final quality of the leather? Therefore, the bating conditions should be geared to the succeeding steps through which the raw stock will pass so as to attain the desired leather quality. Consequently, whether lime is still present or not after bating will be dicated by the method of pickling, tanning, etc. as prescribed by the required nature of the leather being produced.

CHAIRMAN WILSON: I believe that is correct, sir. The first thing that happens when a side leather tanner delimes less, is that he has to pickle more. The balance has to be struck, especially between deliming and pickling.

DR. T. C. THORSTENSEN (Lowell Technical Institute): I do not think this is the time to get into chrome tannage, particularly at this stage in the discussion. But I would like to draw your attention to the original stratigraphic work of Krytzinger and Theis on the question of the lime streak. (*J. A. L. C. A.* **43,** 379, 443, 515, 1948)

You will recall at the time it was shown quite definitely that the method of deliming and pickling controlled to a very great extent the fixation of the chrome through the leather. Consequently, there is a reflection in the quality. The quality was not correlated in that paper, but nevertheless the people who did the work and have followed that in their tanneries, have undoubtedly found that correlation.

CHAIRMAN WILSON: There is a term in the manufacturing of calfskin called, "ribbiness". Al, is there any relation between the amount of enzyme and ribbiness?

MUELLER: I would say in order to answer that question, when you go to ribbiness, you have to go back further than the bating proposition. The problem of manufacture of calfskin, full grained and smooth, particularly with the large trend to aniline leathers, has put pressure on the beamhouse men to do the job properly.

In other words, your skin has to be taken into consideration to be well let out all along the way, but not to be let out so that we end up with very loose, flanky leather. So that the operations for ribbiness have to be balanced with your method of liming, unhairing and the bate. They are all very closely related and tied in together.

ZEISSIG: While we are on the subject I would like to bring up one peculiarity of our company—we delime on some of our stock by using $CO_2$. I do not know whether anyone else makes use of this process or not. We feel we get a smoother grain.

CHAIRMAN WILSON: In conjunction with enzymes?

ZEISSIG: Yes.

MILLER: May I ask Frank whether he could give us just a general outline of the procedure, and what controls are possible?

ZEISSIG: We have the same controls. The degree of deliming is checked, temperature controlled and the pH is taken. Most of our bating is done in a reel and when we delime with $CO_2$ the pressure determining the flow rate of $CO_2$ is checked very carefully.

CHAIRMAN WILSON: I would like to have a side leather tanner, if he would, any side leather tanner, more or less stick his neck out to venture an opinion on whether or not the break of side leather is connected in any way with the amount of enzyme, or any parameter of deliming and bating.

MR. R. HOCKRIDGE (Universal Tanning Company): We have run a number of experiments in our tannery and we have found that it is not so much the amount of enzyme that has to do with the looseness, but the amount of time that the leather is subjected to a high temperature, and we think this has something to do with the accelerated alkaline hydrolysis which is present at the high temperatures used in bating.

CHAIRMAN WILSON: What do you do about that then, shorten the time and lower the temperature?

HOCKRIDGE: No, we find that we do change the amount of time if the skins are away out of proportion to our regular run in thickness. But as Mr. Odell pointed out, by the use of a formate tannage we find we can overcome difficulties in the lime streak and still keep our leather uniformly overall tight, and by not increasing the length of time that the leather is subjected to a 90 degree temperature.

ZEISSIG: Do you think that is due to the rapid liberation of ammonia between the delimng agent and the lime? That has been brought up a number of times in the past and I wonder whether you attribute some of that looseness to the action of ammonia?

HOCKRIDGE: I think personally when you have lime and untanned hide fiber present together, that an increase in the temperature of that mixture will increase the degradation of the hide fiber, itself, and that the longer you keep it at an accelerated temperature, along with wheel pounding, that you get a degradation so accelerated that it will show up as looseness in your final leather and it preferentially—

CHAIRMAN WILSON: And it preferentially attacks the porous areas near the flanks?

HOCKRIDGE: We lime flesh and we find that we leave more flesh on our belly areas—and those areas have a tendency not to be delimed quite as rapidly as the backbone, and are a looser structure to begin with. Therefore, that lime and the temperature gives us an alkaline degradation in that portion of the skin which tends to make that skin in the final leather loose.

KAY: Would the nature of the delimer have any bearing on the looseness?

HOCKRIDGE: I have only used one delimer. I have no idea. But I have changed the amount of enzyme. We have gone up to three times as much enzyme sometimes, and we have decreased the amount of enzyme. But when you are talking bating, you have been talking here delimers and enzyme action—but I think as far as the drastic or deleterious results that can be produced from

bating on side leather, they have to do with the third action which is going on simultaneously—alkaline hydrolysis of the hide fibre.

I. Leo Riese (Beggs & Cobb Inc.): Assuming that you could get exactly the same amount of deliming by using a larger amount of deliming salt for a short period of time or a lesser amount of deliming salt for a longer period of time, would Mr. Hockridge then venture a guess that the stock bated for the longer period of time would come out looser than the stock for the shorter period of time?

This question is based on your previous statement that the length of time at a certain temperature has a lot to do with the looseness of the leather.

Hockridge: We bate in general in the range of forty-five minutes and in that forty-five minutes there are running times and resting times.

Now, we find that if we go up in our enzyme to approximately three times our regular amount, we can delime quicker and by this quicker deliming (of course this costs money, too)—but by this quicker deliming we can get a tight piece of leather. But we find that rather than spending too much money, we control the amount of deliming to a certain degree as best we can, and then with the use of a formate tannage to make up for the discrepancy in the thickness of the lime streak, we accomplish our aims and do not spend too much money to do it. Does that answer your question?

Riese: Partially. I would like comments from the audience or the panel on this idea of degree of deliming. We do know that the amount of enzyme has a great effect on the extent of deliming. But considering all factors as being the same—in other words, using the same amount of enzyme—you are pickling through to the same end pH—suppose you are pickling overnight—complete penetration of pickle to the same exhaust pH and the same tannage—everything the same except for the degree of deliming in the baie, how would that degree of deliming affect the temper and break of the finished leather? Would the greater deliming give you a tighter and softer leather or a tighter and firmer leather, or a looser and firmer leather? How would it affect it?

Turley: We cannot answer the question of deliming—over-deliming or under-deliming. It is impossible in my experience unless we take into account the whole leather making process and the particular product under discussion.

If you have a normal process and you should delime more thoroughly, the chances are very great that you will make a softer leather and looser leather. It just goes that way.

It does not mean to say that you will necessarily make a softer leather or looser leather just by more thorough deliming—until you consider the whole leather-making operation. Those differences exist today all over the world—when you compare the processes of the different tanneries. And it is amazing how much variation there is in a basic factor like that of deliming.

We are talking about controls. Let me interject the idea not of control so much—and I agree with Mr. Ivany that they are not controls but working data which are very often put down in the record and nothing is done about it.

But think about controlled processes. It is a better controlled process if in every case the skin is thoroughly delimed, by having an excess of deliming agent. You have equilibrium then. You cannot control the leather making qualities sufficiently well every day, if you leave that as a hit or miss proposition.

You are going to have some skins today that are fifty per cent delimed and some tomorrow at twenty-five percent, and with heavies and lights, you cannot make uniform leather.

You will say to me that is all wrong because when we do that we do not get the kind of leather we want. I will come back to you and say, "Sure, I agree with that." But if you will go further along the chain of the operation, and study them and have controlled processes, I think then we are going to go a longer way to making more uniform leather.

I believe in this discussion of bating this morning—we are not getting on very fast, incidently—that it is more important to discuss some of the fundamental aspects of to delime or not to delime, a little enzyme or a lot of enzyme, and time, and so on, rather than to compare the various tanners, because there will be great variation all over the country and with different kinds of leather.

ODELL: I would like to try to answer Mr. Riese's question in part.

I think, along with Mr. Hockridge, as to what effect the lime streak in the leather has, I think it is very important whether you are talking about a straight or formate tannage.

When formate tanning, if a lot of lime is left in the leather, rather than getting a firmness, I think you will have a soft solidity. You will have a high basic tan in your leather and it will end up being mellow and soft, where a straight chrome tannage without the use of buffering salts will show entirely different results in the finished leather.

MR. HERMAN C. KAMBER (S. A. Cortume Carioca): I would like to bring another point into this. You asked how much bate should be used, Dave Wilson. I am speaking of side leather now. You can bate lime split stock; you can bate fleshed stock; and you can bate no refleshed stock. I know if you go from refleshing to no refleshing, that you have to either extend your wash before bating, or you have to increase your delimer in order to get your bating down to your desired limit in a certain time.

The question is, how much bate should be used? Should we use an amount of bate based on the white weight percentagewise or should it be based on the area of the skin?

CHAIRMAN WILSON: What is your opinion?

KAMBER: That is the question we have been asking ourselves. When we changed from refleshing to no refleshing we left the amount of bate the same which we determined by per cent of white weight. But I do not know whether this is right.

KAY: You are asking, when you have chunky hide against a spready one, whether to use the same amount of bate?

CHAIRMAN WILSON: Which is the most important—the surface area in the drum or the basic weight in the drum? That is your question, I believe. Would anybody care to venture an opinion on that?

DR. JULIUS PFANNMULLER (Wallerstein Company): To answer this question, I think we should consider the deliming and bating action separately. Our experience has shown that the enzyme action is wanted mostly on the surface of the skin, especially the grain area, and therefore the amount of enzyme should be based largely upon the area of the skin.

The deliming agent—ammonium salt, or whatever deliming agent you are taking, should be based upon the white weight.

Dr. Turley mentioned goatskins before. In bates used for goatskins, usually the amount of enzyme contained in mixed bates is far greater than in bates used for calfskin, side leather or steer hides.

CHAIRMAN WILSON: You are suggesting perhaps that a flexible system might be to base the amount of deliming on the pounds of white weight, and the amount of enzyme on the supposed grain area?

PFANNMULLER: That is correct.

DR. HENRY B. MERRILL (B. D. Eisendrath Tanning Co.): I might say that in our experience we do give the lighter weight skins, which have the greater area, a higher percentage of enzyme, but not only because of the greater area per pound but because the lighter weight skins are bated for a shorter period.

We bate until we get complete deliming as indicated by the phenolphthalein streak and that takes two or three times as long for the heaviest kip that we work as for the lightest skins that we work.

We also find that we have to use a larger amount of delimer on a weight basis for the heavier stock.

I would also say that in our experience the amount of enzyme used, above a certain minimum, is not very critical. We have tried experiments in which we have doubled or quadrupled the amount of enzyme, leaving the time and other conditions the same.

Under those very exaggerated conditions we did get a slightly looser, not quite so full, leather. But since using five times as much enzyme, had a relatively

small effect, we think an increase of ten or fifteen per cent probably does not have very much effect.

MR. BEN A. GROTA, JR. (Fred Rueping Leather Company): I have one question: when you speak of five times the amount of enzyme, I take it for granted you are keeping the amount of delimer constant—is that correct?

MERRILL: That is correct. We use an enzyme which is purchased from the manufacturers without any delimer present and then we vary the amount of delimer. We think that gives us greater flexibility in that we can increase the enzyme, or increase the delimer independently, depending on the weight of the stock we are processing.

CHAIRMAN WILSON: Incidentally, I can read into this whole discussion a suggestion for the applied research field.

It has been rather difficult to talk about deliming and bating separately because most of us actually do the two processes simultaneously.

May I suggest that an excellent subject for applied research would be to try to separate these two for the purpose of talking about them? I am not suggesting that we do them separately. But we appear to be having difficulty talking about the two as separate entities. At least I read that into this discussion.

MR. GEORGE A. BUTZ (Endicott Johnson Corp.): Perhaps we are looking in the wrong spot for the answers to some of these questions.

Quite often I think it is very common for a person, regardless of how much experience he has in the tannery—to get oversold on one particular method of appraisal, such as either feel or texture, or grain, or looseness of flanks, in relation to the other parts of the hide, or perhaps just as a measure of pH. You can even be oversold on the effect of pH in some operations as mentioned by Mr. Kay and several others.

A lot of the situations represented by the questions and comments that are being presented about deliming and bating might possibly be traced back to liming and preliminary hide treatments. Several years ago, a looseness of grain was observed by us which was quite puzzling. We buy and sell, as well as manufacture, finished leathers.

The condition in question was first brought to our attention when leather which was procured from another company caused considerable trouble in one of our factories. The factory diagnosis was "loose grain".

Microscopic examination indicated the looseness was caused by an air separation between grain and corium areas. This discovery led to quite a lot of work with which we were very fortunate in getting cooperation from Cincinnati. It was based on the studies that Roddy made a number of years ago, which have to do with hide fibers in bundles and the coatings of those hide fibers.

We also found some of this condition in our own leathers. It was not general. Occurring only spasmodically, it was difficult to track down especially since its appearance was so similar to that of an overworked condition. A slice with a razor knife just under and parallel to the grain leather would quickly show the air cell. This was found to be already present in hides out of lime.

Thus, we found a lot of the troubles which we thought were in bating and deliming, came from some of those experiences with certain packs of hides from certain areas of the country, and were first noticed in our liming processes.

Cross sectional analysis under a microscope and various staining techniques, showed us that those fibers were not always thoroughly uncoated to the extent to which they could assume and absorb various chemicals and the processes thereafter. Consequently, we were blaming the wrong men, the wrong departments and the wrong materials. Later we found that other tanneries also found some of this trouble.

A condition of hide damage, over-liming or a combination of both could cause this condition. The damaged area would be easily solublized in liming and removed in bating.

This action was illustrated and substantiated by Stubbings yesterday, when he showed you that the main part of side leather, of course, is collagen and that collagen layer is affected by the various delimers according to the amount of, as we would call it, scud or scuff, common to that particular region.

Any hide damage becomes scud and is taken off in a relatively short time. Thereafter your bate does not affect the collagen to too great an extent. However, the effect on that collagen is quite often what affects the folding and looseness which you attribute to the grain layer, when actually it is the supporting layers underneath which do not give the proper filling and suport when you bend and flex in the shoe making operations.

I, therefore, recommend the use wherever possible of the microscopic staining techniques, since only by this method can one see the actual structural changes through the operations of the beamhouse and bating.

CHAIRMAN WILSON: I believe that is an excellent observation. It is only five percent, but do not forget that it is five per cent of 88 per cent. It is a good deal of nitrogen in action, although it looks small on the chart.

BUTZ: It is what holds up the grain. We found there was an air layer in some of the hides—finished sides, we were buying.

CHAIRMAN WILSON: It is your panel's intention to move to the subject of pickling shortly. For the next few minutes I would ask you to keep that in mind and if there are points to be reviewed, let us do that now.

MR. CHARLES T. CARES (John Flynn & Sons, Inc.): I am admittedly an outsider in the side leather field but I am familiar with the fact that on side leather your temper varies from very soft leather to very firm upper leather.

I wonder if somebody would comment on the deliming and bating as it affects the firm leather and soft leather? Do you delime and bate for very soft leather, as you would for firmer upper leather?

MR. BERNSTEIN (Korn Leather Company): We do not make too much soft leather at Korn's, but we have run some experiments and at one time we made a few sides, a small run. We did not adjust any process in the beam house. We simply adjusted our fatliquoring and our drying method.

So, in answer to your question, on the basis of what few we have made, we have made no changes in the beamhouse.

CHAIRMAN WILSON: Could you possibly be leading up to the idea of bating sheepskin? Incidentally, I might explain that that is the reason why Charlie has not been too much in this discussion, because as I understand it, sheepskin is not bated; is that correct?

CARES: Sheepskins are bated to a fair degree. We do not have much control, however, because most of our skins are foreign skins. I was listening to this bating discussion and I was wondering half the time whether bating is a lot of "hooey"—not knowing anything about it.

Everybody is talking about bating and the effects of bating, and yet you make two extremely different leathers and admittedly the bating has very little effect on it.

I am surprised because for years I thought bating had a lot to do with the temper. Yet I find bating has more to do with only the grain. And on a lot of side leathers if they killed all the bate, I think they might be better off.

BERNARD: I would like to more or less contradict that statement because of the fact that bating has a very, very large degree of effect in the quality of all leathers made, particularly glove leather, and particularly calfskins. I believe over-bated calfskin is ruined and I believe under-bated glove leather is ruined.

There has been a good deal said about controls and I think we are still on that subject, more or less. We control the lime—the deliming, with our pH figures, washing and so forth. We control the enzyme action by the strength, the amount of enzyme temperature.

There are some other tests, however, that as stated before, are physical. They are a man's hands—the feel; the amount of air that passes through a skin when the skin is ballooned and squeezed. Some of these tests are not important to the calfskin fellows. They are important to the glove leather fellow.

If the leather does not squeeze any air bubbles through it, when it is bated, in glove leather you cannot make, I believe, real good soft glove leather. I believe these other tests that we make, we squeeze the skin. We see how the skin springs back.

I would like to know if there is some sort of a quick chemical test—a control test—that we could make at the bate, to know just exactly how far the enzyme had progressed. We rely on phenolphthalein on certain types of leather, as to how far the deliming and bating process has proceeded.

I would like to find out if anybody can suggest a quick chemical analysis test that would show the enzyme action that has progressed.

DR. HENRY ROSE (Johnstown Tanning Company): I did not want to take part in the discussion, but I believe I am on the other end of bating. For a certain type of skin I do not bate the skin at all. What Mr. Bernard says is very true—depending on the type of leather you want to make depends whether you bate very much, or do not bate at all. But the deliming for my purpose is extremely important.

I delime usually overnight with ammonium salt—chloride or ammonium sulphate—and I believe for certain effects bating just absolutely ruins a skin. We have now a complete picture of overnight bating, rebating and no bating at all.

GOETZ: I would like to get back to Harold Bernard's question. He wants a quick chemical method for determining enzyme action. I think there are two gentlemen here who could answer the question and facilitate the meeting.

I assume if Dr. Turley or Dr. Pfannmuller do not have a quick chemical method for determining enzyme penetration or action in bating, then I will assume there is none. Harold, you want a quick method first, or what?

BERNARD: We have to find out quick. We cannot find out an hour or half hour, or twenty minutes later.

GOETZ: What is wrong with the test you have now?

BERNARD: It works, but is not a hundred per cent.

GOETZ: What I am trying to get at is: maybe we all try to get too scientific at times but every industry, and particularly a technical industry like ours, involves skill. In the textile industry they would like to have a quick mechanical method for determining softness, but they still determine it by hand.

Here we have a piece of material of which we know practically nothing—that is the protein, hide, itself. And if by using our hands— as in the balloon tests and it works pretty well, why worry about it?

DR. PFANNMULLER: Maybe I should call your attention to the works of H. N. Moore which are published in the Journal of the American Leather Chemists Association 1949 and 1952. We studied fully the bating process and especially, the influence of the enzyme. Instead of using the normal tests of a beamhouse foreman, he measured the physical changes occurring during bating with mechanical instruments. He measured the relative permanence of deformation, the slipperiness of the grain, and the relative air permeability, all with fine mechanical instruments. However, I am afraid that the methods and apparatus he used would be too cumbersome for practical application but his findings might serve that you become well acquainted with action of the enzyme, especially on the grain. Dr. H. N. Moore paid especial attention to the increase in the grain area obtained during bating and also investigated microscopically the influence of bating on the fiber bundles.

I am afraid, however, that his methods are not yet adapted to give the bate foreman practical tests so that in a short time, he could determine when he should stop his bating.

I have wondered why nobody of the goatskin tanners present has entered this discussion about bating. Kidskin tanners bate both suede leather and grain leather. I guess the kidskin tanner would not divulge any secrets if he would tell you how kidskins for grain leather are bated and how kidskin for suede leather are bated. These two bating procedures are entirely different.

ERERA: I thought I made the point clear when I first said that the glazed kid we bate overnight, Doc. And on suede, we have what we call the running bate—about an hour, with enzyme and delimer mixed together. We run for about an hour, with resting in between, and then we pull them out and wash them and then they are ready to go into a pickle drum. Those are the two types of leather we bate.

TURLEY: I would go along with Harold Bernard and Goetz' suggestion.

Some years ago, before this Association, my Associate, Dr. Morse, and I published a paper on the enzyme method of unhairing. In that case a very large quantity of enzymes were used. The process was further simplified chemically by the fact that there were no ammonium salts, and only sodium salts present.

We found, of course, there was a breakdown of protein—not as much as had been thought, however, in that particular case we found it was sufficient to break the protein down into relatively large blocks—not nearly as far as the peptone stage, and certainly not amino acids. I was going to say that it might be possible to get a chemical method whereby you take an aliquot of your liquor and get a rough idea of the enzyme action as is reflected in the production of the break-down products. You would have to do a tremendous amount of work to see how that worked in practice.

We have given it some thought, but it seemed in the everyday practical way of bating that some of these simple tests which you mentioned, at least for now,

are pretty good. We know they have drawbacks. We know you cannot always rely on the quality of the workmen.

On the other hand, when you get into a chemical examination, you do not have something which is quick and that necessarily reflects the condition of the bating. It is something that the industry might look into, particularly in research programs.

MILLER: In regard to Charlie's question on the effect of bating on different types of leather, I think Dr. Turley answered it quite a while ago the best, when he said that you cannot pinpoint one process and say what it actually does; that if you have a well delimed and uniformly delimed skin, there are so many other places in your general process that can affect softness and firmness, and fullness, and flatness, that just to say that one process can make firm leather for bags, cases and straps, or glove leather, is very difficult.

CHAIRMAN WILSON: Very difficult.

RIESE: Every tanner is well aware of the effect of any one part of his process on any one leather property.

Dave Wilson posed the question of the effect of extent of deliming, and I feel it has not been discussed at enough length. Odell did mention the fact that he thought that if too much lime streak were left in the leather on a conventional acid tannage the leather would come out firm, and as you continue to delime it would become softer. Would that mean that it would become looser also, Odell? (Not present)

Is there anybody else who might answer that question?

CHAIRMAN WILSON: I would venture a "yes" on that.

RIESE: How do you account for the fact then that a lot of side leather tanners particularly are familiar with the type of hide where you have very thin belly and shoulder areas, and when it is processed the same—bated the same, usually that belly area is completely delimed and yet when it is dried out, as a rule it has a very tinny feel?

CHAIRMAN WILSON: I cannot account for it.

RIESE: What I am driving at is this: can a change in bating accomplish a certain amount of remedy?

GOETZ: Relative to the tinny flanks, and I am just inserting this as a question: might it be that since it is so well delimed that as soon as the pickle hits it, it becomes so thoroughly pickled and the pH is so low, that in the flank area you may have a very acid tannage which gives you flat, tinny leather?

CHAIRMAN WILSON: Another explanation might be that the particular hide which you were talking about, that one with the thin belly, may have been predestined to be flat and tinny, regardless of what you do to it? (Laughter)

MARTIN: I would like to ask this: last year we were on bating the greater part of the afternoon. This morning we have kicked bating around for better than two hours. Bating is no longer just a simple set-up in a tannery. We are going to have biochemists and a few others down there to run the tests. I think we are getting a little far afield. I wonder if we could move on to pickling?

CHAIRMAN WILSON: This program is mainly audience participation. If that is the wish of the audience, we will move on.

Deliming leads to pickling and perhaps we have to go back to talk of deliming in relation to pickling. Actually, the two processes together bring the processed material from a high alkaline condition down to an extremely acid condition —the first one taking it part of the way, and the second one the rest of the way, or most of the way.

It is a general procedure in probably all leather processes with the exception of vegetable tanning, that leather is pickled. Many sheepskin tanners buy pickled hides. That is the start of the process.

I wonder if we can start out on that line because many sheepskin tanners do buy pickled hides. What are some of your requirements?

CARES: I don't know that I can answer that question. As you know, we have no control over our beaming of sheepskins. Our only requirement is that the pH be low enough to control the deterioration in storage.

CHAIRMAN WILSON: How about goatskins?

ZEISSIG: In the goatskin field pickling is a regular process. We use a Baumé of between seven and eight.

Pickling is a very important step in the manufacture of goatskins. We use a different pickle for suedes than we do for grain leather. I would like to have Louis elaborate on that.

ERERA: On the grain leather we hold the pickling down a little lower. We do not use as much acid as you mentioned for the simple reason that we are going into a two-bath tan and it is going to get some additional acid in with the bichromate.

But on suede we give it the one and a half sulphuric acid and the usually eight to ten per cent salt, and we like to horse them up for about 48 hours to get it completely struck through.

MILLER: Apropos of pickling as it affects side leather, I want to borrow a term from Dr. Turley. When he spoke of bating, he said to lime or not to delime. And I think we can apply the same phrase to pickling—to pickle or not to pickle, or the degree. Of course we are all looking for uniformity of product —uniformity of processing, so that I think that any work that we do in our tanneries, to give a more uniform pickle, is the thing we should strive for.

As far as degree of pickling, there we come into the inter-relation of where we have to decide what type of tannage we are going to put on top of it. Therefore, we have to set our sights from that viewpoint, and not just to say, 'Well, it is going to be pickled."

We have to decide the extent of the pickling—not as to uniformity, but degree of acidity—how strong the pickle is going to be, or how weak it is going to be. But I think that if we are looking for uniformity, we should do everything that works toward a uniform pickle.

I would imagine Dr. Turley would again suggest from the academic viewpoint, the equilibrium pickle. Correct?

TURLEY: I hoped there would be a little introduction to pickling just to get us all on the same standard plane. After all, I suppose, pickling is a preparatory process. Why do we pickle? Go ahead and argue that out, and what is the effect on the different tannages? It is a big subject.

Pickling is relatively new. In the old classical methods of tanning, pickling was not done. When chrome tanning was introduced, pickling became an important part of the leather making operation. It is the operation which really brings the skin from the original treatments, the alkaline treatments, into a suitable condition for the acid treatments.

Now you can see how it is tied into the bating—whether large or small streaks of limed fibers are left in the center of the skin is going to influence the pickling. So that at the stage you will get large or small streaks of acidic areas, or relatively alkaline areas.

In some horrible cases you will find the centers of the skin still alkaline. Mr. Cares will know that you get the most amazing abnormalities in commercially pickled sheepskins, even considering they are coming from all over the world.

To get on with the point, I have become convinced in the last few years that again, for the sake of uniformity—uniformity of quality of leather, which shows up in returns, in grading, that one ought to strive in the pickling process to reach the equilibrium conditions.

Alkali from the bating is again reflected in the pickle and whether or not the formate process facilitates it against the more orthodox process is really beside the point. I would challenge anybody to prove that even with the formate process you would get, on careful examination, that uniformity which we should have if you have a varying acidic condition of the fibers within the hide.

So that when you are thinking about making more uniform leather, it does seem to be that striving for more uniform condition of the fibers is the important thing. In other words, more uniform pickle—and that is related to the amount, time and temperature, and so on. And when you have that, you have a uniform product to put into the tan, and then the same principles apply there.

The tanning is somewhat similar to coloring and fatliquoring and so we go on down the chain.

I am convinced that today the equilibrium conditions are going to give, for the long run, the more uniform leather and it is a part of this pattern of what we call controls, again. It is not necessary to have measurements which are mere chemical checks. They are not controls. But a better control is to have the skin always in a uniform condition for the next process.

CHAIRMAN WILSON: Thank you.

I happen to agree with you on that point, Dr. Turley. But I would not be a bit surprised if we could get another viewpoint. Is there anyone who believes that there should be a slight alkaline rise in the center of the skin? In the preparation for tanning?

ROSE: I would like to mention something that has nothing to do directly with pickling. I am a little late with the suggestion, perhaps. Actually it was last year that Mr. Rhoads made an excellent suggestion to conclude the meeting—to leave the open questions for research—and to be answered by pure research in Cincinnati or some other place. We have a lot of questions open in bating, and probably by the end of the discussion we will have a lot of open questions for pickling.

If we have concentrated research on questions that are open, they could be tackled in a purely scientific way and we will probably have much faster progress and an answer to the practical problems much faster than by purely theoretical curves which he will have to translate later into practice, sometimes with success and sometimes not.

We have had liming—and deliming—lime streaks, and so on. I would like to have somebody formulate the questions at the conclusion of bating and pickling, and then present these questions to those who can work on it to secure us the answers from pure research in the laboratories.

CHAIRMAN WILSON: Thank you for the observation. I certainly believe that many people, both practical and technical, are doing a lot of thinking as we go along in answering that question for themselves.

I can recall two questions that came up this morning. One was the request of basic research to provide a tool to measure the end point of bating. That is one that comes to mind. That is a tough assignment for basic research perhaps. (It might be easy: I don't know.)

DR. DONALD F. HOLLOWAY (R & M Industrial Laboratories): I just want to ask Dr. Turley what is the criterion for the tanner of an equilibrium pickle? How does he determine how much acid to use to get his equilibrium on, say side leather?

TURLEY: That, of course, is a very pertinent question. I believe, at least for the present, if the fibers, by spot test, are in approximately the same pH from the grain to the flesh, that we are making progress for the present. Whether or not there is just as much acid found in the different tannery labs, I don't know. I think some of the stratigraphic work could be criticized on this basis. There was not too good an understanding of the equilibrium of the pickling processes before the tan was put on. The stratigraphic process merely shows what we arrived at. For the present, if we take a pickled skin that seems to be uniform by direct spotting with colorimetric indicators, to that pH which we have found satisfactory for making our leather then that is not a bad method of doing it right now.

ZEISSIG: We control the pickling on goatskin by titration and pH. In most cases we run the leather in the pickle until equilibrium has been reached. It may be fifteen or twenty-two cc. of $N/10$ NaOH on fifty cc. sample of the pickle liquor. If necessary the pickle is adjusted.

CHAIRMAN WILSON: That is the liquid part of the system?

ZEISSIG: Yes.

CHAIRMAN WILSON: The ultimate definition of equilibrium is the point at which the skins and the surrounding system have no effect on each other with further time. Of course we never attain that in practice, and perhaps a good working definition of an equilibrium pickle might be that point at which a layer-wise acid measurement, titration or anything similar to it no longer shows an alkaline hump in the center.

TURLEY: Titration merely measures amounts of acid absorbed by the skins and does not show where it is. I don't want to use the word "control". It is a good thing to measure. Let's put it that way—to know how many pounds of acid you put in and how many you take out, and then you know whether you are doing it uniformly.

This other question is much more important—the theory of having the skin fibers in the same electrical condition. That does not mean they have to be isoelectric. You might not want to have them at pH 5, for tannage. (Or you might). But whatever pH you find is suitable, that is what you should strive for.

And then we are going to have the same difficulties that we had with this question of liming that was touched on. There you are going to have your acid

existing in several forms. You will have excess acid which you can easily see in the case of pickled skins, which drains off. Then you will have the capillary acid solution which is clinging in between the hide structure—between the fibers of the skins. That again is something which can change on storage.

But the amount of acid combined with the hide fibers and collagen fibers is going to determine the next reactions—the rate, speed and manner in which tanning takes place. And it is that electrical condition of the fibers which is the important thing to strive for and that is what we mean when we are talking about the equilibrium condition.

Incidentally, sometimes it is just a question of time. The pickling may not be quite uniform in a certain period of time. If it is the practice to horse skins up overnight and select them, and so on, then very often they become uniform again.

On the other hand, if the time in the pickle is increased, there again the condition of the skins becomes uniform.

HOLLOWAY: What pH would exhaust pickle liquor have in an equilibrium pickle? Assuming the skins, for example, may be calf and have been pickled overnight and you assume they have pretty well come to equilibrium, what sort of pH would you want on an exhaust pickle liquor where you were trying to reach equilibrium?

TURLEY: I see I have not made myself clear. I do not think that is so important, in itself. It is important when you have the process set up—that you determine what the pH's are—you measure them for the record, to see what are the variations. But I believe that the actual spotting of the fibers with colorimetric indicators in the pH ranges which are operating, is a far better way.

You may have an equilibrium pH of liquor in which there is still a very small amount of alkaline fibers in the center of the skin. To be in equilibrium it would take a much longer time for that to straighten itself out. But if you spot that skin with indicators, it is relatively crude and there should be better methods—you can see at what time and point they are reacting in a uniform pattern, and spotting with an indicator will give no change in color; you won't have any different colored layers in the skin and there will be one uniform color all the way through. It may be in the range of three, three and a half, or four, or four and a half, or five—according to what you think would give the best result.

CHAIRMAN WILSON: It is 12:15, and we will adjourn for the morning. We intend to resume at 1:30 and continue on the subject of pickling.

(The session adjourned at 12:15 p. m.)

---

## Wednesday Afternoon Session

## May 25, 1955

The meeting reconvened at 1:45 p. m., Mr. David Wilson, presiding.

CHAIRMAN WILSON: Gentlemen, we are running a bit behind time. I would like to announce at this time that your panel had luncheon together and discussed a few points of policy on this meeting, and generally speaking, we felt that the meeting went pretty well this morning.

However, there is one point which we felt could stand a little bit of improvement. We would like to ask your cooperation this afternoon in this respect:

It appeared to our panel that there was a good deal of simple comparisons between tanneries this morning. We were simply standing up and expressing opinions based on our own experience, which of course we want, but what it boiled down to was a simple comparison of the differences among and between tanneries.

If possible, this afternoon, your panel would like to have more discussion on the fundamentals of pickling and tanning, as much as you can generalize. I know that a man's experience is in terms of details and what he has done in his own process, and so forth. But I think there is a little bit more generalization that can be made this afternoon in pickling and tanning, and we ask your cooperation in that respect.

We started with sheepskin when we started talking about pickling and we have decided to continue on that subject, particularly with reference to degreasing of sheepskins, which apparently is a part of the process.

It is not a problem apparently of the sheepskin process. It is part of the process, a normal part of the process. And in order to start this going, I would like to call on Charles Cares to tell us a little bit about the degreasing in conjunction with the pickling of sheepskins.

CARES: I have been along for the ride for the most part this morning, and perhaps looked a little stupid sitting up here.

Degreasing is a necessary part of our operation and I understand from being on the panel, that the goatskin men have to do some degreasing, but it is a small part of their operation. Most of our skins come to us in the pickle. At the present time most of them are from foreign countries. We have very little control over the beamhouse and consequently have to live with what we have.

But degreasing is very important and getting more important every day. With some of the processes that are in effect today, degreasing becomes more important all the time.

In our tannery we sort our skins and grade them in the various grades and make them up in packs. We mill them in a small amount of solvent to loosen

them and fluff them up. Then we flesh them—partly to remove the lumps of fat, and partly to remove some of the moisture.

After fleshing, the skins are entered into a drum with a tight door and a warm solvent is added, a specified amount, depending on the type and weight of the skin. The solvent is added warm at a temperature of between 90 and 95, and the drum is run until the temperature inside the drum reaches approximately 95.

At that time we add warm brine at a temperature approaching 95 and run for approximately an hour.

To regress a bit, we do carry an emulsifier with the solvent, I forgot to mention. Then we add the warm salt brine and run for approximately an hour. At the end of an hour we slat out as much as will reasonably run out and then we further wash with a warm salt brine.

We in our tannery wash with a specified amount of salt brine, at 7 Baumé The emulsifier used is very important. We experimented with a lot of them and we have ended up with a nonionic emulsifier that does a pretty good job.

I understand that the degreasing is more or less of a normal degreasing job, but there are some tanneries that have a completely different set-up on degreasing. I wonder if Mal Battles might tell us a little about his process.

MR. MALCOLM H. BATTLES (A. C. Lawrence Leather Company): I will do what Charles has asked and then at the risk of seeming like an expert, which I am not, I will talk a little about the fundamentals.

Our process differs from the one Charlie described, mainly in the means of expressing the solvent from the skins after degreasing. We have used basket type centrifuges for sometime and it is an effective means of expressing the solvent from the skins after they have been slatted off at the end of the drumming with solvent.

This is the only essential difference between what we do and what practically all the others do.

In degreasing there are several points to be considered. One is the type of wetting agent to be used, to facilitate the entry of the solvent into the skin. There is published work which indicates that either a cationic or anionic type of emulsifier is to some degree substantive to the protein. It would leave anybody with a normal conclusion that a nonionic is the preferred type of surface active agent to use.

This has a disadvantage if the emulsion formed between the brine and the solvent is stable. It makes recovery of the solvent very difficult. By selecting the proper surface active agent most tanners in this area, and I am sure elsewhere, have been able to overcome that.

The emulsifier is the first important thing, and the second is the time and temperatures of drumming with the solvent. These factors are pretty much worked out on a practical basis.

The last important thing is the means of expressing the solvent from the skins and it can be effected in several ways. One is mechanical, such as we do in centrifuging. The other common method is to drum with a salt brine. This more or less physically displaces the solvent from the skin. I think that is about all I have to say at the moment.

CHAIRMAN WILSON: Is physical strength the ultimate thing that is important in strength?

BATTLES: Yes.

CHAIRMAN WILSON: Do you lose strength through degreasing?

BATTLES: You can, if it is not properly done. But the main purpose for degreasing is the removal of grease. As you know sheepskins contain up to fifty per cent grease on the dry basis and makes greasy leather if not taken out.

CARES: In the degreasing operation the sheepskins are very tender and care has to be taken that the temperature does not rise too high. When your temperature approaches 100 you approach the dangerous area.

I was hoping that some of the other sheepskin men would be in here. I know Shepard has some controls on their salt brine. We have something pretty much the same. We have a tank above our degreasing room wherein we regulate the temperature and the Baumé of our salt brine.

That barrel or tank above feeds into all of our drums through one four-inch pipe and if the Baumé drops below the specified point, there is a gong that rings and a light goes on, and an automatic valve shuts off, so that you cannot draw anymore brine.

The same thing happens if the temperature rises too high—it automatically shuts off and you cannot draw anymore brine.

It has worked very well for us. We used to spoil a few skins— not too many, but occasionally somebody would forget and the temperature would rise too high in the wash water, and when that happened, God help us—because we completely lost our lot of skins.

ZEISSIG: Is there such a thing as over-degreasing provided your temperature is correct?

CARES: I have heard that expression but I have yet to see skins that are over-degreased purely in degreasing.

There are other factors—temperature too high or the salt brine not strong enough. I have not seen in my own experience any occasion at all where I could say the skins were over-degreased from the fact that too much grease was taken out.

For that matter, at the present time we are all, I think having a serious problem of getting enough grease out. Some of the new processes have aggravated the grease problem that we have been able to live with, with normal leather.

ZEISSIG: I have heard it said that if too much grease is taken out, that the leather has been tender as a result of that grease removal; is that true?

BATTLES: I don't think that I can say with any authority that it can happen, but I would feel if the leather is tender as a result of the degreasing process, it is probably something physical other than the removal of grease. The process that you have used has in some way weakened the skin.

CARES: I think it is possibly more mechanical than chemical at that stage. Now we might turn to other types of leathers.

BATTLES: Before we leave the subject of degreasing, perhaps Mr. Kay would like to discuss greasy bends on sole leather, which is not a small problem today. Aren't some tanners using methods of degreasing sole leather?

KAY: Not that I know of.

BATTLES: I disagree. I happen to know there are.

CHAIRMAN WILSON: The reason we are on the subject of degreasing with respect to sheepskin is because it is a necessity, an integral part of the pickling process and we felt that probably it was wise to include that in our discussions. I am curious to know whether this is also a necessary part of kidskin manufacture. Is that so?

ERERA: It is only necessary in certain types of raw stock that we get.

CHAIRMAN WILSON: The very greasy ones?

ERERA: Yes, the very greasy ones which only run about five per cent of our normal production. So we do a degreasing more or less along the lines described here, except that we do not use as much degreasing fluid.

CHAIRMAN WILSON: Is there a hide sorting in the beginning of the process?

ERERA: We determine at the fleshing machines whether the skins will be degreased or not degreased.

CHAIRMAN WILSON: Would anybody like to add to the discussion from the floor?

If not, I would like to go on to a subject which I think perhaps is rather provocative, and that is the effect on leather which we side leather tanners call "drawnness" and for which there are perhaps other terms. It has been said that "drawnness" is in some way connected with the pickling process and particularly the salt-acid combination, and the times that are involved—time of exposure to salt before acid is introduced for example.

In general the connection between "drawnness" and acid swelling—is there anyone who would like to give us his thinking on that matter?

MUELLER: Let me say there may be a connection I would say that my experience has been, and it looks as if it is an inter-relation between the condition of your pickling and going into the tanning process.

In other words, examining pickled stock with umber, looking for certain defects in the leather, it is in most cases pretty difficult to pick up unless you have gone overboard on the situation of which you speak. However, on going into the tannage, if you are not properly adjusted for the tannage, if you have a sufficiently exaggerated condition, you bring it out in the tannage and it is aggravated at that time. So it is inter-related between the two processes.

Dan Lord, can you help me out with a question or two?

MR. ERSKINE D. LORD (J. S. Barnet & Sons, Inc.): If I get the question right, it was a question whether pickling accentuated draw grain.

CHAIRMAN WILSON: Is there any connection between the variables of pickling and drawn grain?

LORD: You have to answer "yes" to that question I think, because in working out any given process for any given tan you are going to adjust your pickle and adjust your tan so that at the end of the tan you come out smooth.

If you have a low pickle, if you have a pickle with a relatively high pH, you begin to get surface tannage rather quickly in the tanning, you will get drawn grain. On the other hand, if you have a higher pickle or lower pH, when you go into the tanning, you will tan your grain much slower, you will try to tan the the inside of the leather and let the surface tan last, so that you will have something to hold up the surface when it does tan.

I don't know whether that answers your question, but it is my thought at the moment.

MR. HOGAN (Flynn & Sons): Why would not that go back as far as the bating—your depletion of fiber when you leave your bating and why would not the depletion of fiber and the rapid action of the surface acid cause the "drawnness" on your leather.

MILLER: Along with what Dave said on the relation of "drawnness" or chicken wire effect, or whatever you want to call it, on the grain, I believe you can couple that to almost any process that you want to, where the action has not been smooth or uniform. Some of the belly draws that we know, coming from the beamhouse, are accentuated. They are tanned in, never to come out again. Or, if there is a rapid deplumping which can work the same as a rapid plumping, or if someone is pickling skins with low salt concentration, where they have very uniform swelling due to the acid present, most anything could happen under those conditions, I should think.

Then, not to get into the tanning end of it, but just the inter-relation there—whatever you have put in there, you are going to set with your tan and you have it. It is there. So I do agree with Dan Lord that you can get it there, but you get it in other places, too, if your action is rapid and un-uniform.

LORD: May I go a little further along that same line? I think the configurations you are giving your tan, under the most ideal conditions, reflect the configurations you have already put in the leather or neglected to take out of the leather in your liming and bating.

Therefore, I say that the configurations that you get, your drawing and one thing and another, are very greatly affected by your previous processes. But they may be accentuated in the tan. Do you agree on that?

MILLER: Yes, I do. I used the example—possibly it is a little far fetched—that the characteristics of each and everyone of us, both physical and mental, are pretty much set by the genes and chromosomes at the time of conception, and I like to liken tannage as that point of conception where every chromosome and gene has been added to it all the way from the soak through the liming and bating, and pickling and all the mistakes and all the good features that you put in it are going to be there.

ZEISSIG: I think you can get a piece of drawn leather in the pickle—if the conditions are just right. What the conditions are, I would like to have a little more discussion on. I know on kidskin we get draws in the pickle and I know on other types of leather there are draws in the pickle.

I think if you look closely enough you can see them. Sometimes they are not so noticeable and are not brought to light until the tanning process.

MUELLER: Let me say this, that while we are hedging around here on this, it all ties in with the basic fundamentals of each operation. Theoretically, entrusted to us, is the idea of making, if we are making full grain smooth leather—making it without a draw and if we recognize in one process what may give us a draw, it is up to us not to overstep in the other process and to eliminate the draw.

You have to anticipate that. So if you can see draw coming in your pickle, then you have to alter that effect either by taking care of it in the pickle or taking it previously to where you have introduced the draw—such as a beamhouse draw from the liming process as opposed to loosening the grain and making it susceptible to a draw and bringing out the configuration in the tanning process.

CHAIRMAN WILSON: Are we on common grounds on this subject? Let me offer this as a suggestion: each and every hide, regardless of whether we are talking about calf, kid, side, upholstery, perhaps has a predestination either to be drawn or not to be drawn, or to be somewhere between the two extremes for a given process. And that the average of the process must be designed to cut down the bad tail of that distribution—to cut down the fraction defective, so to speak.

Dr. Turley nodded "no" when I made that statement. Dr. Turley, will you say something on that?

TURLEY: This idea of the predestination of a skin is really something fantastic. For this reason: please pardon me when I say it—but that idea is for the first year of tanning—the way you instruct students in tanning. Don't worry about quality. If there ever was a craft or skill in the making of leather, it is that very thing that the tanner must do and he cannot help himself. Certain raw stock has been purchased and he has to get the most out of it if he is a good tanner.

The question of whether the skins are predestined to have wrinkles, whether they are predestined to have loose flanks, I would not say. We just have to use all the ideas we have and do a better job.

I had a recent session with some California tanners and we were talking about this very thing—wrinkles, which appears in the finished leather.

I put it this way: that really the wrinkles are not in the hide that God made. You made it. It got put in the leather some way or other and it is a question of tearing the process apart and finding out where it happened.

Of course what we were talking about a moment ago is very important—it can always be done in the pickle if conditions are not right. If the hides are not conditioned before the pickle—the gentlemen back here referred to pre-bating, of course, but the pickle won't change that—won't take out something that is already there.

Say you have a smooth skin that you cannot criticize, you can still get draws in the pickle. There is a big difference in different processes, in the way they are juggled around.

I rather agree with Mr. Miller. I think he is very happy to have a fatherly interest in chrome tanning. We must have at the same time, a motherly interest, too.

What are the factors that make for that smoothness? As far as we can see them in a general way, it is just maintaining an undisturbed fiber structure from grain to flesh and whatever we do we must not magnify that. If, unfortunately we put wrinkles in at one stage, we must try to take them out at another stage. Because if we leave them in, by the time we tan the skin, it is too late. It is fixed.

It is a very interesting question between the different ideas of tanners. This could be a big subject.

Some aim at making exceptionally smooth leather through the process which, when it comes to the drying operation, stays that way and needs relatively little mechanical action to get a good product. Others work in a different way. They won't be so particular about the grain surface but put in a lot of mechanical action and one must admit they make a very good appearing piece of leather. It is very smooth.

I think if we look at it a little more carefully, there are small differences in the case of the tanners who try to overcome some of these defects with mechanical action. You will see the tendency of that leather to come back again, particularly when it is made up in the shoes or when it is used. It just seems that the other idea is nicer.

So I am going to everlastingly object to any ideas that such and such a skin is predestined to make a plump leather or smooth leather, or stretchy leather. If we do that we are just forgetting the whole craft, and the science of leather making. We have to do better than that.

CARES: There is something I would like to bring in here. On sheepskin we have that problem on many of the skins. I know part of it is due to the natural fiber itself, but a good deal of it is probably done in the beaming. Maybe some of you fellows in heavy leathers who have control of your beaming, know how to eliminate it in the beamhouse.

But we do see it in the pickle. Has anybody had experience in letting it out after you see it in the pickle, and where you have no way of controlling it before the pickle? It is a serious problem with sheepskins—this chicken wire effect—particularly on suede.

Mal, do you think anything could be done on that? Have you had any experience?

BATTLES: We have had experience but I cannot say we have solved the problem.

CARES: I thought that where you have more relationship with both beaming and tanning—that possibly you might have come across that same condition and have seen it corrected. I wonder whether it could be applied to sheepskin?

BATTLES: I have seen it helped at times but I cannot say I have ever seen it eliminated. I think everyone in the sheepskin business has at one time depickled and rebated, and found that it is very difficult to remove these defects by that procedure. I cannot say I have ever seen a complete solution to it.

CARES: Do you think that a pretannage of a synthetic tan might stop the skins from drawing anymore when it goes into chrome?

BATTLE: I would not want to comment.

CARES: I see Fred Freeman has come in and maybe I should get back to degreasing.

We talked about normal degreasing and Mal Battles has spoken of his way of removing grease. I know that Fred for years has press degreased and has recently gone to wheel degreasing. Would he comment on that and his reason for changing?

MR. FREDERICK L. FREEMAN (Naumkeag Tanning Company): For several years—in fact for a period going over twenty-five years, we did press our skins preparatory to wheel degreasing. However, we found that occasionally we ran into whole packs of skins where we could not mill back the stock and get the plumpness we wanted due to the mechanical action of the press. We could not eliminate the wrinkles caused by the press.

About three months ago we went to wheel degreasing. As far as our form of degreasing is concerned, we drum our skins for an hour and a half in a solvent solution with emulsifier added. We use a high amount of salt in our brine washes. I understand that several of the sheepskin boys are currently experiencing difficulty with stains.

I had occasion last year to bring several skins to Bedford Springs and have the boys on the heavy leather examine them. Although I did not get any specific help from them, I did get quite a few suggestions.

In line with some of the thoughts expounded down there I increased the amount of salt in our brine washes and found I minimized these stains to quite a degree, to the point where it was no longer disastrous to put a thousand dozen skins in to the works.

I find currently I am not troubled at all with stains, but some of my good friends approached me at this meeting to find out how I eliminated them. It may be because I am using a 20 per cent solution in our brine washes to degrease. I cannot think of a single other thing.

CARES: How strong a solution?

FREEMAN: A 20 per cent solution. On wheel degreasing we have to make sure we will remove all the grease. Otherwise we will have a lot of trouble.

CARES: You feel the stronger salt brine has helped you in removing the grease?

FREEMAN: Yes, absolutely, and I tell you frankly there is a definite correlation between drumming time and temperature. It is an amazing thing but we have found over a period of, say, six months, that in the morning, for instance, we have to put our solvent solution to work on pickled skins at 120 degrees in order to achieve a temperature of 100 degrees at the end of 90 minutes.

We feel that we have got to achieve that 100 degrees in order to get the grease to flow, so that subsequently the brine solution will wash it out. But on the second run of the day, in the afternoon, when the wheels are heated up, we feed our solvent at 90 degrees and we find that we can achieve our 100 degrees in 65 or 70 minutes, whereas it took 90 minutes on the first run.

But there is a definite correlation between running time and temperature and the drumming of the skins in order to discharge the grease.

CARES: Does anybody have a temperature indicator on the wheel? In degreasing, the end temperature is very important. If it is too high, deterioration takes place. Does anybody have experience with indicators in the wheel, while the wheel is operating, to give you running temperature?

FREEMAN: We have thermometers within the wheels so that we know at all times the temperature of the wheel. We watch it closely. Because if it goes too high it can dissolve your protein and cook it. We have to be very careful on that, and the way we govern it is through our brine solutions.

We have to watch our temperature. For instance, in the middle of the summer I anticipate this: I have not reached it yet but I know that I may even have to use ice to cool down my brine solution to hold the temperature down to the point where I can run the skins better than an hour to achieve the result I want.

ZEISSIG: You say you add brine to the wheel and then run it for an hour?

CARES: After the solvent run, yes.

ZEISSIG: How important is the brine? I have heard it said that if it is run too long, or if there is a wrong relationship between skin and liquor, you pound that grease right back into the skin instead of taking it to the surface where it can be removed by slatting.

CARES: We have found that an hour works satisfactorily for us. I don't think that we have ever run much longer than that. I cannot really answer where the danger point would be where that might happen. Does anybody else know whether too long a run in the brine would affect it that way? Fred?

FREEMAN: I would not say that you drive the grease back into the skins, but you would tend to tenderize the skins by running it too long at that point.

On pressed skins, where we have press wrinkles, we have to drum them after the solvent degreasing in a small quantity of brine in order to work out those wrinkles. We found out that if you ever went over a half-hour drumming point you would start to strip the grain and make the skin tender.

As far as the grease going back in the skin, that would be the lesser trouble of the two. You really ruin the skin if you run it too long at that point. You cannot do it.

CARES: Have you found the minimum time you should run in the salt brine to get your maximum effect at that stage?

FREEMAN: I would say on wheel degreasing (forgetting the pressing operation) that we add approximately 150 gallons of brine after the completion of the solvent. It runs for a period not over 20 minutes. Frankly, at that time you have achieved the optimum in heat and you are up to 100° as far as your skins are concerned.

You put in your brine at 90 to hold the temperature back but nonetheless the skins have a costly heating up. So I would say that the limit, to be safe, would be 20 minutes after you complete your solvent operation.

MILLER: Not knowing the first thing about degreasing sheepskins but listening to you fellows talking about it, it seems to me that you have two operations going on at once in your degreasing operation. You have a degreasing and a depickling operation. If you wash pickled skins with a warm brine water, I am sure you are removing acid. Is that a factor, and is that controlled in any way?

CARES: In our last wash water we add some acid. Surprisingly, you do not raise the pH too much in that washing. More or less only the surface is raised as far as we can see. We add a small amount of acid in the last wash water before we go into tanning, to allow for that. Has that been your experience, Mal?

BATTLES: We have not followed that part of it too closely because when we come to tanning we make a pH adjustment before tanning.

KAY: On the question of the fat going back into the hide, would it not depend on the type of emulsifier used? You are creating an emulsion and if it is an unstable one you might split your emulsion and it would go back in. With the newer types of emulsion that are more stable, you would not be so apt to get that effect, perhaps.

CARES: Mal, will you comment?

BATTLE: That is absolutely right. Some tanners are still using an anionic detergent with or in place of the nonionic. And the anionic is the one that would be susceptible to mechanical breaking.

ZEISSIG: We do some pigskin degreasing and we have been very careful that skins do not run too long in the first brining, and I wondered whether the same thing follows on sheepskins and how important it is. That is why I brought up this question.

CARES: It might be interesting to bring out the correct application of the emulsifier—whether it is better to put it in directly with the solvent, or better to drum it into the skins before the solvent is added.

Mal, do you feel that the emulsifier is in there to assist the solvent in penetrating the skins, to displace the water?

BATTLES: I think the wetting agent is serving as a means of entry for the solvent. This subject is well covered in the paper which has been published in the British Journal and that was their feeling also.

CHAIRMAN WILSON: I don't mean to break this up, but we must move on, and get back to the main subject of pickling with respect to all tannages.

Just before Dr. Turley got up I noticed Charlie Martin was about to put his hand up. Do you have anything on the subject of drawnness as related to the pickling variables.

MARTIN: On drawn leather maybe Barretts could give us some suggestion. They do a very good job of drawing and make money at it.

There are a few other things to be said about this drawing. You could start in your beamhouse when you are worrying about drawing. You can either accentuate it or correct it by the way you handle it from then on out, and it is not held down to your chemicals.

If you have a fairly smooth piece of leather after you have tanned, you can still end up with a hungry, drawn piece if you won't toggle it and open it up and pull it out. This is not all chemical. There is a lot of mechanical handling. And a lot of those times—like this morning we were talking about ribs. You can have your ribs and you will have them from the beamhouse.

You are not going to get away with it. In a calfskin, say you have a young bullhide, a bully skin, they are more ribby and the time of the year that you get your skins, the take-off and everything else will affect your ribs.

But in your mechanical work, and shaving—some people will tan a piece of leather and actually they are looking for a plump piece of leather. And I don't think you are trying to get the most out of the thing when you do that. You leave your heft there and sacrifice smoothness because you do not go to the maximum shaving that you should. You are not opening it up enough to get the skin

down and out. There is not a department in the tannery that does not have a bearing on the following operation. You cannot say that this happens here and that happens there.

I have found it to be one of the toughest things—that when you see something wrong, that you do not say, "That is down in the bate." You can get into trouble faster by making a snap judgment and thinking you know where all your troubles are. If you watch every step along the line and try to keep it to a maximum safety factor—taking your pickle: there are some that have a very low salt. Salt is not expensive and if you want smooth leather it will not hurt to put a little more in. It will help you.

At the same time, the amount of acid that you are using, or how low a pH you are pickling to—if you have a very low pH and put on a high basicity tan, you will probably come out at the middle level. You can start at a higher pH and use a lower basicity and come out with about the same thing.

But that is just something you have to work out in your own tannery—the way you run it, the speed of your drums, and how fast you do it, and what you do afterwards, and what you have done before.

I do not think you can settle anything—say pickling to an equilibrium. We do. We have a very low pH. It works for us. It may not work for you. You have to work everything out.

If you go back to many years ago, Dr. Turley gave you a definite formula. You have almost a straight line and when you go down in one department, you just do not let go or raise hell when it gets to the sorting table. You make your adjustment if you are watching your leather. Everything has to be compensated.

This drawn grain you can blame on a lot of things, but if you watch your step and are very careful, you won't have too much of it. I still would like to know how they do it in Newark.

CHAIRMAN WILSON: Would you care to comment, Mr. Salamatov?

SALAMATOV: Well there are two things. One is when you draw your grain for yourself; and the other is when you get it in spite of yourself.

For Charlie's ease of mind I will say that it is not done in the pickle. (Laughter)

Now, as far as the influence of the acid on the drawn grain is concerned, when there is a sufficient amount of salt, I do not believe we should talk about acid causing any draw. If there is enough salt, I do not think there is acid swelling. I think the better conclusion would be that it reveals the draw that has been caused by possibly quite a number of instabilities before that.

I have heard once or twice an expression of an old foreman who has been doing nothing but tanning for some forty years. He told me that the pickle is a blessing for the tanner because it covers almost all of his previous sins. It is true in one respect, but maybe those times have passed.

As far as pickling as an operation is concerned, to produce a certain effect on the quality of the leather, I would like to get this discussion to flow back into the banks of the river—not the outside of the banks.

We are trying to talk about influence of different processes on the ultimate objective of the quality of leather. Now in this respect pickling is only a part of a chain of operations that we have been talking about quite a number of times here.

In our operation, pickling is not an operation by itself; it is a beginning of tannage. Now, I mentioned in the morning that bating we consider as leveling off for our beamhouse processing. When that is done we transfer the skins to an entirely different department, entirely different supervision, and we start a certain concentration of acid, and we do not care whether it will take ten pounds or twenty pounds, or thirty pounds, in order to achieve a certain pH on the skins—not in the solution.

Pickling, then is a preparatory operation which brings the skin to a certain pH at which we want to start our tanning.

Important and pertinent questions that I would like to hear discussed from the floor here are things like this: let us ask how much influence will there be in difference in concentration?

When the total amount of acid is the same and the concentration is different —how will it affect the quality of your leather? That is what I like to hear about. Whether or not, let us say, a raise of temperature of five degrees—whether that is going to affect the quality of leather.

As far as actual figures are concerned, I am not interested in them at all because we have already said that pickling has to be tied in with things that were done before, with things that will be done later on. From the standpoint of developing or influencing the quality, I think a uniformity of the pH on the skin is probably the most important factor—at least it is the most important factor in our tannery. That is what we are looking after, and there is no tanning done before the skins are brought to the pH that we desire to have.

As far as the surrounding liquid is concerned, I did some work a number of years ago and I know that you may be misled quite severely by titrating the exhaust liquor and making a deduction that your skins are right because the exhaust pH is right, or that the skins are wrong because the exhaust pH is not what you want to have. I didn't mean to say pH, but the titration figures.

Now within a given set-up of the things, approximately, you will find, that if you add let us say one per cent of acid in order to produce a certain effect on the skins—I do not say to reach equilibrium because that is something that does not happen—but in order to produce a certain effect that you want to have, and then either by design, neglect, mistake or any unknown factor, it happens that you have either too much acid or not enough acid, I found out that the solution will have a sort of automatic self-adjustment.

When you have too much acid, there will be more of it left in the exhaust. When you have not enough acid the exhaust will be very weak. But the skins will have the tendency to pick up as close as possible to the one per cent we started with. So the only safe guide to go by is testing the pH of the skins, themselves, and not the surrounding solution.

Another point on reaching equilibrium; we throw skins into the pickle always in the alkaline condition and we put the acid on, so as to bring about a pH, let us say, of three. Now it takes probably a couple of hours to bring the condition about when your skin will have, let us say a pH of four, and the surrounding liquor will have a pH of two.

It will take another six or eight hours to effect the difference of 2-1/2 for liquor and 3-1/2 for skins. And then it may take 4 or 5 days before you reach equilibrium. Therefore there is always a certain disproportion. You always have to have a little excess of acid in the solution before you reach the pH which you want. Therefore, I do not think we can talk about reaching equilibrium in the drum. We can get as close to it as we can, but factors of time and production schedules and so on, will have to influence you in a way that you would not reach that hundred per cent.

CHAIRMAN WILSON: Your working definition of equilibrium then is a level distribution of acid through the thickness of the skin?

SALAMATOV: Well, I would not put it that way. I would put it this way; that my definition of the proper pickling is reaching a desired pH in the skins, and again you would not have it all the same—depending on the thickness of the skin. Let us say surface pH—you begin to judge the things in one way or another, and once set a standard for yourself, you go by that. Our standard is that we have to have a very definitely, strictly controlled pH condition.

RIESE: What method has Mr. Salamatov used in determining the pH in the skin most accurately?

SALAMATOV: What we do—we make two cuts on each piece of skin and use two adjacent indicators. One, gives you a pH of between three and four, and the other, between four and one-half and five and one-half. So that you always can be safe that you are not over one limit and not below the other. In other words, we bracket our pH.

MILLER: In answer to Andrew's question that we should have discussion or work on concentration of acid, and also of temperature of pickling. I would first like to comment that I agree with him when he said that the pH of the skin is the most important thing and I do not know whether I misunderstood him when he said that the uniformity through the cut was not important. I understood it that way and I have a tendency to disagree at that point.

But on the point of concentration of acid, there is a paper which was published, I believe, in 1933 or 1934, by Theis and Goetz on concentrations of salt and acids and their effect on the skin at that time.

As I remember the conclusion is the pickling tended more to depend on the concentration of the salt and the amount of the acid rather than the concentration of the acid.

Of course, if we stick to fairly good tanning practice, so that we have sufficient solution to insure that all skins receive their portion of it, I do not see where a long discussion on concentration of acid would mean anything. I would suggest that possibly we should try to give you the quickest answer.

On temperature, I believe in that same work there was some work done on temperature, too.

The best way to state it, I would say, is that we need a temperature that is high enough to insure good chemical activity, but not high enough to do the skin any damage.

I think that most of us like to keep pickling at reasonably low temperature. One time we had a drum that was a bit fast in speed, and the mechanical action was such that the pickle would heat up quite a bit. And we found that at elevated temperatures that we did have considerable trouble with fiber strength. So that if we keep it within the realm of normal room temperatures, I do not think we have to worry. I do not know whether anybody else has experiences along that line.

CHAIRMAN WILSON: Is that strength of the leather the only manifestation of high temperature pickling—too high a temperature?

MILLER: That is the only one that we noticed. It was quite obvious and it was taken care of right away and we did not look for other characteristics.

CHAIRMAN WILSON: Mr. Salamatov believes there may be another.

SALAMATOV: I am sorry to say that I was misunderstood. I did not want to discuss this thing as a matter of theoretical exposition. What I wanted to find out is: if we, let us say, pickle at 70, and then start pickling at 75, is there any difference in the quality of leather? I did not want to go into any theoretical discussion of this thing at all.

The same aspect applies to the other variables such as concentration of the pickle. Is it better to put 15 pounds of acid into a hundred gallons, or put 15 pounds of acid into a hundred and fifty gallons? When you do that and we get the skins, which skins are better? which skins are worse, that is the point of view of my approach.

CHAIRMAN WILSON: Would it not be a reasonably good rule of thumb that in order to reach the condition you want in the skin, that the 15 pounds of acid

should be used in an amount of water, the largest amount of water, which will do the job for you in the amount of time that is given to you to do it?

SALAMATOV: I do not know.

CHAIRMAN WILSON: There has to be a certain amount of mass action—a certain difference of concentration between the system and the skin before pickling will take place.

MARTIN: Let us take a sulphuric acid pickle and you have 100 per cent water, as against 150 per cent water with acid of 2 per cent and salt, 8 per cent, and I do not think you will see much difference. If you get down to 80 per cent water, I do not think you will get into trouble. But the lower you get and the more concentrated the acid, the more I think you will find your fiber strength is going.

As to temperature, Andy, we run ours from a tank. The water is kept quite constant. You cannot cool the tank very easily in the summer, and it gets a little warmer. But we have not experienced much difficulty, nor have we seen a variation by pickling at 70 degrees or 75 degrees.

The only thing, in water temperature, is that in the winter if skins have been piled in the pickle and they are so cold, we have to warm them up in a warmer brine than we normally would.

CHAIRMAN WILSON: Mr. Freeman?

FREEMAN: We had an experience a few years ago working on small lambskins—small Lincoln lambs—about a foot and a half to two feet per skin, and we were trying to achieve a suede finish on the flesh side with a lack of color on the wool side.

We had to do some fooling around in the beaming of them. We did not want to remove the wool, but at the same time wanted to bate them so as to tan them properly. We found out there was a definite correlation between the solution in which you had your salt and your acid in relationship to the plumpness of the leather, that you could achieve. The higher we went on salt and acid solution, the more we thinned the stock out.

This may go back to Charlie's original question about bulkiness on sheepskins. If you want to draw your pickle you plump your stock up. So why can't you do the opposite and give them a strong pickle in order to thin them out?

On these Lincoln lambs, one of my boys erred one day and had a lot of water in the wheel, and I could not understand what happened. But by loading up that wheel with salt and acid we managed to correct it and get the skins back to tan.

But as far as the last gentleman's question is concerned, whether temperature at 70 or 75 degrees means anything, I would say positively yes—that the higher you go, the more you will plump your leather. If that is what you want, O K. But if you want to thin your leather out you should stay down to low temperatures.

CHAIRMAN WILSON: By plumpness, are you talking about the thickness of the finished product or the bulk density of the product?

FREEMAN: The thickness.

CHAIRMAN WILSON: What other manifestations in the fiinshed product might come from elevated temperatures—not extremely elevated temperatures but moderately elevated? In other words, a change in process from 70 to 80?

MR. ROSS G. DONOVAN (The Collis Leather Co., Ltd.): There was a report not long ago that a finer grain was achieved by a higher temperature. We tried it and could not detect any difference. Has anyone here had experience?

MILLER: When you say "elevated" teemperatures, just how high is high?

DONOVAN: We changed from 70 to 80 degrees.

CHAIRMAN WILSON: Going further into pretannage, if possible could we talk about the subject of organic pickling—organic acid, or masking—whatever you prefer to call it? I am speaking of the general field of either adding organic acids to the pickle, or actually pickling with acids such as sulphuric or hydrochloric acid.

Many side leather tanners today are calling themselves formate tanners. Some actually are, in the strict sense, and some are not. Some really are formic acid picklers, you might say, as the two things are actually very closely related.

The formic acid pickle, as I remember it, came originally from Germany, was quite popular in Germany, and perhaps still is. I don't know.

I am interested to know from any of these six viewpoints here what fundamental differences in the finished product might obtain between the formic acid pickle and the sulphuric or hydrochloric acid pickle—any of the three.

MILLER: I would like to ask you a question, Dave: regarding the people who are using a masked pickle—what is the reason for their doing it? What are they trying to accomplish by masking the pickle? Are they trying to introduce a masking agent to the tan, or are they trying to accomplish something in the pickling?

CHAIRMAN WILSON: I am not sure. The chemistry of the thing, of course, is involved with chromium. Whether it be a formic acid pickle or the addition

of phthalate, formate or any other organic acid to the pickle, I think the chemistry is the same. It makes a difference whether you do it in the pickle or the tannage. But it is involved with the affinity for an organic molecule for a chromium atom.

I do not want to get into the chemistry of this. This is a practical meeting. What you are asking, of course, is with respect to leather qualities and advantages to the tannery?

MILLER: More or less, at what point are they trying to accomplish something—something directly related to pickling, or directly related to the chrome tannage.

CHAIRMAN WILSON: I would rather not answer that outside of saying that it is probably related to the quality of the leather that is produced. I would not want to go further than that.

Are there any formic acid pickles in the United States today? I don't know. (No response).

Are there any straight hydrochloric acid pickles in the United States?

ZEISSIG: Yes, there are. The kidskin people use hydrochloric acid quite extensively as a pickling acid. In some cases they will use hydrochloric and sulphuric. We use both. The conception is, I think, that you get a softer piece of leather with hydrochloric pickle. I question that, but I have heard the statement made.

CHAIRMAN WILSON: You believe there are no great fundamental differences between the two?

ZEISSIG: I do not think there is a great difference between the two. However formic acid would make a vast difference and be quite different from either hydrochloric or sulfuric. As a rule a little more hydrochloric is used than sulfuric.

The kid tanners do a number of things which they feel make quite a difference in the process.

I think they do more of that sort of thing than perhaps the side leather or calf people.

MILLER: May I ask a question: is there anyone on the panel or in the room, who used a two-bath process? What is the role of the pickle in that process?

ERERA: The role of the pickle is the same as any other tannage. You want to prepare your skins to accept the tan. But we do it in two stages, actually. We start out with a lower amount of acid in the original pickle and then we

add the bichromate with some more sulphuric acid to set up the bichromate in the first bath.

MILLER: In that case, are you interested in controlling the pH in penetration as was discussed here on regular pickling?

ERERA: No, we don't pay too much attention to the penetration at that point because we feel that we will get the penetration in the first bichromate bath.

MILLER: In other words, your penetration of bichromate will serve as a good indicator of your penetration?

ERERA: That is correct.

MILLER: The other part—the control of the pH, is that similar to people who just pickle and use a one-bath?

ERERA: Yes.

CHAIRMAN WILSON: Getting back to leather qualities and their relationship to the pickling as a process, I would like to go back again to that masking question.

I could repeat here that the advocates of masked pickles have said that, especially with reference to formic, that a decreased tanning time can be obtained among other things. That is probably the strongest point.

I will have to admit that, although the Fred Rueping Leather Company uses a masked pickle, we do not take advantage of that feature.

In order to attain this condition that Mr. Salamatov speaks of, the same from day to day, and going along with Dr. Turley's viewpoint on equilibrium, the Rueping Leather Company feels that an overnight pickle has a lot to offer. I say, then, that we do not take advantage of that feature of masking.

However, any masking agent (perhaps not many, but a few) have the property that the titration curve of the system is entirely modified. It is no longer really a strong acid. It is a buffered system. The first thing that happens when you add sodium or calcium formate to a pickle is that the pH rises and yet it still has high acid capacity—pickling capacity, so to speak.

That is an aid not only through the tannage but all the way through the rest of the wet processes, because it turns out that it is extremely difficult, for example, in the later process of tanning, coloring and fatliquoring—to change the pH of the blue shaved leather.

So that perhaps more drastic treatments can be done at that time without danger of, let us say, going below this level of acidity pH 3, an arbitrary

figure, but which has been decided to be a dangerous point in the deterioration of the finished product.

A great deal more acid can be added to leather at that point without hauling it down below pH 3, which is supposedly the danger point.

SALAMATOV: As far as formic acid and formates are concerned, some years ago we ran small pilot packs pickled with formic acid and pickled with sodium formate, and we finished them.

We could not find any advantage as far as the leather was concerned. We abandoned that after running four to six experimental packs. As I said we could not find any advantage. Yet formic acid costs about seven or eight times as much as sulphuric.

CHAIRMAN WILSON: Isn't it generally true that the violet tint as opposed to the green tint of a formic acid pickled leather, or a formate masked leather, offers a little more desirable base for white leather?

SALAMATOV: That I don't know. We never tried to make white leather.

MORRIS: On the matter of using formic acid in the pickle, I agree with your statement a hundred per cent, that an overnight pickle is advantageous and beneficial; in which case I would not see any point in adding formic acid. But in a tannery where the facilities are not adequate for the amount of production required in a leisurely manner, and trying to get out more production with not enough facilities, and if you want to speed up the process and thereby use as short a process as possible, that on the average run of hides of a short beamhouse process, that the addition of a small amount of formic acid in the pickle will speed up the penetration of the acid and therefore the tannage through the lime streak.

As far as adding sodium formate in with the pickle, it is not necessarily a matter of the masked pickle, but a matter of ease or convenience of handling to run a short pickle with the formate in first, and then the addition of the chrome afterwards.

I see no difference between adding the sodium formate in the pickle or adding it in the chrome tannage, or with the chrome, in the finished leather. I think there is a little difference with calcium formate in that respect, however.

CHAIRMAN WILSON: The sludge that forms?

MORRIS: Not necessarily the sludge, but because you get a different complexion with calcium formate added in with the acid, your ultimate tannage does not have quite as much of a violet tinge as if it is added to the chrome.

CHAIRMAN WILSON: In other words, the chromium molecule is probably much more quickly and easily modified when done in the chrome one-bath itself, rather than in the presence of hides in the drum, and so forth.

MUELLER: I would like to interject a few words to ask about mechanical effects. If we surveyed the group of tanners here and found out and took the average—if we became statisticians and got our square and our mean, we would find probably that the pickling operation for our purposes falls pretty well into a certain line and that the variations in the pickle are very slight.

But I would like to know and get some comment from you people on mechanical effects in the pickle, such as drum or paddle pickling. Would anybody care to say a few words on this?

CHAIRMAN WILSON: Is there anybody who has experience with both?

BERNARD: I would like to say that I think mostly the overnight pickle is being done—mostly on the heavier leather type and usually in a paddle.

I think it is customary on overnight pickling to pickle in a paddle. Whereas lighter leathers are more generally pickled in a drum in a shorter period, sometimes not more than an hour.

We find that in making a comparison which I have been doing here recently, on some calf leathers that have been pickled in a drum with sulphide process preceding—as against a lime method and pickling in the paddle, that you would think the drum pickling would be looser and more open, but it does not show up in that way.

I think the previous treatment where the skin is fleshed once in the green and once out of lime, or if it is only fleshed once after sulphide, has some bearing on the degree of openness.

But we do not see any particular tightness difference in the leather that is pickled in the paddle than what is pickled in the drum. I do feel it is easier to control a drum pickle than it is a paddle pickle. Because there are certain other things than salt and sulphuric acid carried into a paddle where you make up a paddle and carry on the process for one week or two weeks. I think the pickle becomes infected with certain portions of the hide, flesh and such.

Dr. Turley brought up the question of why we pickle, I know why we pickle. I don't know why somebody else does, except that it is part of the tan.

In our case we pickle because we have different tannages. Our tannage has to be decided on in the pickle and want to sort for each. We have other operations that we perform in the pickle. As was brought out, there is a lot of degreasing done in the pickle. And if you degrease in the pickle, you pickle differently than if you are just going to tan a lime—sulphide skin where you have a bate, pickle and tan operation all together.

I would like to say this much for those fellows who have some trouble with grease: that part of the pickling operation, if it is done in the drum, there is a certain amount of grease that can be taken out of the skin before the pickle. And then a certain amount after the skin has been pickled.

To answer the question in point, I have not noticed that the paddle pickled leather is to any degree tighter in break, less loose, than the drum pickle when tests were made on calf skins.

I however, feel that a drum pickle should be run with long liquors, and a point there—that not the percentage of salt is the point, but the actual percentage of salt in the solution. In other words, a ten per cent salt solution rather than so many pounds of salt, to so many pounds of skin, is the factor.

Of course, with the acid, it is more the percentage of the acid on the pounds of skin.

Ross: This morning Dr. Turley and others gave their opinion that the equilibrium pickle was the best. Yet I have always had the opinion that the majority of side leather is made without an equilibrium pickle. I wonder if some side leather man will enlighten me a little bit?

All of these fast processes of bate, pickle and tan in the wheel—you would not consider that an equilibrium pickle?

Miller: Being the side leather representative on the panel, I am afraid I have to agree with Dr. Turley.

Ross: Then can you answer this: isn't it true that much of the side leather made is without an equilibrium pickle?

Miller: Yes, I believe it is true. I cannot answer for anyone else. We try to approach it—possibly do not quite make absolute equilibrium—but we do try to approach it.

There are quite a few side leather tanners in the audience, I am sure, and we would like to hear their opinion on it.

Zeissig: Dr. Turley had in mind the ideal condition. I do not think he said it could not be done or you could not make a good piece of leather that way, but it would be an ideal condition if you could reach that equilibrium.

Turley: We were talking about the ideal equilibrium from the pH of the fiber point of view.

I do not think as yet we have had enough thought on the difference between these organic and inorganic acid pickles.

The organic acid pickle is an old idea. It goes back to the tanners' attempts to overcome some of the effects of the strong acids.

There is not much of a problem if you are going to pickle strong. It does not take long to get the skin in a uniform condition, as you sheepskin tanners know. Sometimes you glove tanners also know that.

But as tanning progresses, we get more critical with the chrome tanning and the tanner tries to improve his appearance and feel, and he would like to turn to a higher pH for his skins. It becomes increasingly more difficult with a strong acid like sulphuric or muriatic. Say you want to achieve a pH of four. It takes a very little sulphuric acid and as Wilson pointed out earlier, on the effect of the masking action, there is very little pressure to drive it on.

You can eventually get your hide at a uniform pH of four, but you will not do it quickly. There is not enough acid there, and keeping in mind the effects of the alkali brought over the beamhouse, this half per cent, or three-quarters, or even less of sulphuric acid is a very small amount.

Now, through knowledge of the chemical behavior of the acids the tanner then found he could produce the higher pH range with a weaker acid—formic acid being a good example. That, incidentally, was quite commonly used in Germany.

We had a number of formulas over here from Germany before the war. They made a type of leather which satisfied them. Some of the outstanding tanners here played with this idea, but it did not satisfy us. The leather was nice and kind, and mellow, but tended to be weak on the grain.

Actually such leather found a place in high class shoes for more or less older people. Our own leather had a ruggedness and resistance that was more desirable for general shoe making.

So, we can achieve this equilibrium more quickly with these organic acids, and by taking a thick hide, in the relatively short space of an hour or so, by using a larger quantity of a weaker acid, we can achieve our higher pH of three and a half or four.

The only comment I have to make on that particular point of organic acid is that by actual comparison, it seems to work out something like this: it is an excellent way to make a somewhat mellow, soft leather, but not so good when you want to make the other kind of leather.

So, it is possible to achieve this equilibrium in a relatively short time by using a weaker acid.

Then, of course, comes the further complications (and you can't help it) of carry over into the chrome and you have a similar set of conditions there. According to the excess that you have or have not, you react with the strong acids in the chrome and you make a change there. So it carries right through.

But I think we should give a little more thought to the fact that these weaker acids do achieve the easier and quicker production of pickles, and the pickled leather is at a higher pH.

In Germany they are using other acids. Whether or not they have any advantage—a number of practical people here have tried them—however, it is not reasonable to expect great changes. They do not produce much difference, but they do help you achieve a result in a much shorter time. But we ought to keep in mind the essential nature of the weak acids versus the strong acids.

CHAIRMAN WILSON: I heard somebody voice the comment as Dr. Turley was speaking, "Possibly better, but more expensive."

The formic acid pickling does not necessarily have to be done with formic acid. I do not mean straight formic acid pickling, but combination formic-sulphuric. There might be argument on this, but I am of the opinion that the formate salt combination with sulphuric acid under the proper conditions can produce equivalent pickling. That is perhaps a chemist's viewpoint, but I do not see any other viewpoint to argue against it.

BERNARD: I would like to ask a question: what would happen to a formic acid pickle if you had to degrease on top of it?

CHAIRMAN WILSON: I cannot answer that.

BERNARD: Can anybody answer that? (No response) Dr. Turley, can you answer that?

TURLEY: There is a difference, as I think you realize. When you have these rather heavy, strong acid pickles such as is typical in sheepskin, you get rather a tough sort of product. You can knock it around and beat it around and also you can kerosene degrease and treat with brine, and so on.

When you get the skin at a higher pH, it is just more delicate. I do not want to be taken too literally, but it approaches more the bated condition if it is left at pH seven or seven and one-half, even if it had salt present. It would be a delicate sort of skin, and I, therefore, feel that it is that underlying condition of the fibers that makes it not possible to give the severe mechanical treatments to formic acid or sulphite pickled skin, as with sulphuric acid pickled skin, with a maximum of salt in it. As you know, when you dry that out you have a dense fiberous structure.

CHAIRMAN WILSON: Is there further discussion along these lines?

Are there any reviews which we should make of the subject of pickling? Are there any more questions? I am sure we have not covered the whole subject.

TURLEY: Forgive me for making another remark. I do feel that as a result of the discussion just prior to this that you have a very fertile field for research.

There has been a need for it for a long time. It is this question of the resistance of skins to different treatments. There is no doubt about it in your

minds, I am sure, with experience, and in my mind, with experience also, that the collagen from a steer hide is a tougher sort of thing than the collagen from a small calfskin. An in turn, the collagen from a sheepskin is a more delicate thing.

So that you do not have the ability to treat all of these skins the same way. When it comes to the effects of temperatures, pickles, bates, adding of salt,—and you only find out to your own cost and I do think we ought to have a good catalogue eventually of the upper limit of resistance of collagen, the native collagen, not tanned, to temperature effects and have that catalogued and really understood. Then we will know why a sheepskin man says, "I can't do this," and a side leather man says, "I can't understand that—we do it all the time."

That would be an excellent subject for research and it is going to be done sometime.

CHAIRMAN WILSON: Is there further discussion on the subject of pickling from the audience or the panel?

Well, now a little bit later I think we ought to say more about what Dr. Turley was just talking about—the basic objective of our meeting. But perhaps we can wind up the meeting that way, Dr. Turley, and review what we have done today, and perhaps come up with some suggestions for research.

Our Organizational Committee had a pretty tough time on this subject of tannage. We have been talking about pickling which most naturally would lead into the subject of chrome tanning. And I would assume that a survey of this meeting probably would show a preference for the discussion of chrome tanning.

Actually, as you well realize, we are not going to cover much of the subject of tanning the next fifty minutes. So perhaps we can launch into the subject of chrome tanning, knowing that next year this panel discussion will be centered again probably on tanning, both vegetable and chrome tanning.

I understand that recently the upholstery leather people have been doing some chrome tanning. Is that correct, Ell Dee?

COMPTON: I have heard rumors but nothing definite. We are not.

MILLER: To more or less formally introduce the subject of chrome tanning, following pickling, we have to keep in mind again our objectives. What are we trying to do?

I would like to think of chrome tanning as having either of two objectives. One is to take the pickled skin which has been brought through the beamhouse and other operations, and fixing those qualities there, as I mentioned before.

The other phase of it is where you will impart characteristics of the tannage, itself, to the skin. That of course will take in other tannages. Of course, chrome

imparts its basic characteristics. Vegetable tanning material will impart its own characteristics, and others also.

Most of us who chrome tan go on top of a pickle or make up a new salt brine in which the pickled skin is placed, and introduce a basic chromium sulphate solution to this pickle or salt solution.

There are many and various types of chrome tanning solutions—varying in basicity quite a degree. There are quite a few masking agents that over the years have been introduced to the tanning material for various reasons. That the chrome tanning solution is usually drummed, (although some people do paddle, but I do not think there are too many left) until the chrome material has penetrated through the skin.

It then begins to take up with the collagen, and we begin to tan. It seems that there is a definite change in the character of the skin. Where before it is pickled it is a putty-like material, it begins to take on a rigidity and to firm, to have some substance.

We then further increase that tannage to our own desires by additions of alkali, to further raise the basicity of the chrome salt in order to fix it on the fibers.

There we introduce another variable which changes the characteristics of the leather.

We have, as I said, any number of basicities, any number of masking agents. We have any degree of neutralization that you desire. So that in this group of people here, I do not think they have covered all of the possible combinations that are possible with those variables.

Therefore, in a tannery we usually select what we feel is, in our minds, the proper basicity that we would like. In our particular tannery we like to select one that is in line with the pickling operation, so that we do not have a drastic change between pickling and tanning. We try to set the chrome to bring it out so that we have a fully tanned piece of leather.

Now that question is always open for discussion—what we mean by a fully tanned piece of leather.

Normally, the chrome tanner, when he speaks of a fully tanned piece of leather, refers to the age-old boil test. I know that it means little, in a pair of shoes, possibly. We don't usually boil our shoes. But it does give some indication as to what has happened in the drum. So that we have a great number of combinations.

The main feature that I think is possible to discuss is, what do various basicities or various combinations in the broad sense, give to the leather? If it takes on the characteristics of that basicity then you have that in your leather.

I believe that we also have in our group here people who are using two-bath tan, the forerunner of the one-bath, and the skins would take on the characteristics of that tannage.

That is just to more or less generally speak about the tannage, in order to open up the possibilities of some of the things that we could discuss.

CHAIRMAN WILSON: I am tempted at this time to ask some provocative questions, but I would like to hear from some of the others of the panel. Louis, many kidskins are chrome tanned, in fact, most kidskins are chrome tanned, aren't they?

ERERA: Yes, the types of leather we make are all chrome tanned.

CHAIRMAN WILSON: Does a kidskin chrome tannage resemble in most respects tannages from the other different viewpoints? Or is it a two-bath tannage?

ERERA: In our particular case, we two-bath our glazed kid skins. We went to one-bath but we found the yield was not as good as with the two-bath. So we went back to the two-bath.

We feel that we get a much smoother grain, greater yield and the grain is softer and silkier, from a two-bath tan.

ZEISSIG: We use both—one-bath and two-bath. The two-bath mostly for black glazed kid and the one-bath for colored kid and linings. On suede, we use a one-bath tan.

Now the two-bath tan gives us a much softer and, as Louis said, a silkier grain.

We do not pickle. We take our stock right from the bate. Our pickling is done in combination with the tannage. It goes in with the dichromate in the first bath.

CHAIRMAN WILSON: Al, would you like to say something on the tanning of calfskin?

MUELLER: I would like to say this from a practical standpoint, which may be of some interest to the audience present: that we have done several things. First, we tried making up our chrome liquor. We make our own chrome liquor, glucose-reduced bichromate and make it up both ways—adding glucose first and then adding the acid. And we have found over a long period of years, that—the thing was evaluated for a two-year period both ways—and on the table of the finished leather there are no indicated differences.

Second, the neutralization of our chrome tannage; we found out something which does not seem to be in general agreement with what is usually practiced, and we have had a lot of opinions on it—that is we use soda ash for neutralization of our chrome tannage. We feed it in slowly and have it made up to a certain concentration.

However, the interesting thing is that every time we try to use the equivalent amount of sodium bicarbonate against the soda ash, the leather is much more flanky, and this seems to be in direct contradiction to some of the opinions I have had from people.

Perhaps this will stimulate some thought from the audience. These are two points that I can bring out, on our chrome tannage.

CHAIRMAN WILSON: Would you like to say anything about chrome tanning of sheepskins?

CARES: Chrome tanning of sheepskins is not too much different than other types of leather except that our tanning time is much shorter. It is not unusual for sheepskin tanners to complete the tanning operation in two hours. And some are doing it in a lot less time than that.

Actually, with the use of formate, I cannot personally see any reason for longer than two hours. We can get our skins to a full boil coming out of the wheel and on those that do not reach a full boil coming out of the wheel do so within twenty-four or forty-eight hours. It may be interesting to see how long other tanners have to run their liquors in order to get penetration. On one-bath chrome can the kidskin tanners move along as fast?

ZEISSIG: No, it is an overnight tan, usually. We start in the morning and it is an all day tan. This one-bath of ours is a combination of pickling and tanning, and we continue right on through the day and set overnight. We finish our neutralization in the morning and then wash.

By the way, as far as these masking agents are concerned, we have never been very successful. We have tried several of them on kid.

When we use formate or any other type of masking agent we get a tinny, flat piece of leather.

CHAIRMAN WILSON: I would be interested in hearing from a tannery that at the present time is experiencing both paddle and drum tanning.

MR. JOHN N. JORDAN (Griess-Pfleger Tanning Company): We have both types of tanning. Paddle tan is a three-day process approximately, and the drum tanning is overnight. We get a much heavier piece of leather out of paddle tanning, though. Also, we have to change our chrome for that. We reduce our own chrome for the paddle and use commercial chrome for the drum.

CHAIRMAN WILSON: By "heavier", do you mean thicker?

JORDAN: Yes.

IVANY: I would like to add a word to the age-old controversy that Mr. Mueller touched upon— of adding the glucose last or the acid last.

If we examine what we are trying to accomplish by glucose reduced liquor, the answer is obvious, at least to us. We are employing what is really the oldest masked tannage known since chrome tanning started, namely, utilizing the organic by-products formed by the oxidation of the glucose.

Obviously, temperature is an extremely important factor in here, in view of the fact that some of these organic by-products are volatile above certain temperatures.

Again it should be very obvious how you will obtain higher temperatures which would be undesirable in this case. If you keep adding the glucose to the boiling mixture of acid and bichromate solution, the oxidation, and subsequent volatilization will take place much more rapidly than if you add the acid last under carefully controlled conditions, not allowing the temperature to rise above a certain degree.

Now, anybody who is interested in the subject should read the next to last issue of "Das Leder" where Kunzel made the most exhaustive quantitative and qualitative study on this subject.

MILLER: On the point of the manufacture of the chrome, Mr. Ivany, isn't it rather difficult to control the reduction in order to obtain the same amounts of masking agents in each batch?

IVANY: By starting out with a mixture of bichromate and glucose, at a given temperature, adding the acid through a circular lead pipe with small pinholes in it over the entire reduction tank, you can regulate the flow of acid in such a way that the temperature will not vary more than two degrees up or down.

MILLER: What about local action in the reduction tank?

IVANY: We feel that by virtue of the fact that this coil covers a large area of the tank, and with a certain amount of agitation with air, we reduce this localizing action.

MILLER: A lot of people are of the opinion, and especially those who use $SO_2$ reduced liquors, that they would rather start with a uniform product free of masking agents, and add sufficient masking agents of the ones that they desire. I think that possibly that might lead to a little better control. I just wonder what your thoughts are, Mr. Ivany?

IVANY: I agree.

BERNARD: I have a question to ask: what do fellows do to get rid of sulphur in making the two-bath tan? How do you eliminate sulphur coming out of the leather in the later process?

ERERA: We still have sulphur left in our leather, but we feel it adds something to the leather. But you are talking about the sulphur at the end?

BERNARD: Yes.

ERERA: We usually wash the skins for six or eight hours—until we get a certain pH and we find it controls the sulphur pretty well, by a continuous wash.

ZEISSIG: We get some of that bloom but it does not seem to be objectionable. We wash for a considerable length of time—not six or eight hours, but two hours.

BERNARD: What type of washing?

ZEISSIG: Washed in a paddle.

BERNARD: Some use square beaters down there, don't you?

ZEISSIG: We use the beater out of the bate before we pickle.

BERNARD: Some use the beater out of the hypo too, don't they?

ZEISSIG: We do not use the beater for that.

MILLER: What is a beater?

ZEISSIG: It is a square three or four foot drum made out of steel and looks like a domino. This beater is ribbed on the inside and full of holes. Water is fed through a gudgeon similar to a regular drum. We wash our skins after bate in these tumblers and I can assure you they get a real beating.

MILLER: I believe someone in the back row wanted to comment on paddle and drum tanning; also Andrew here.

SALAMATOV: If I may, I would like to ask what was the concentration of chrome liquor in the paddle compared with the concentration of the chrome liquor in the drum? I do not think the concentration is the same. At least it looks to me that way.

And then, the question of differences in quality of leather will be a function of quite a number of variables—time, concentration, different mechanical action.

I would appreciate it if the gentlemen can tell whether or not it is the same concentration.

JORDAN: No.

A. HIRSCH: I would like to ask whether the yield of a paddle tanned leather is higher or lower than that of a drum tanned leather?

JORDAN: You get a thicker piece but a small area.

CHAIRMAN WILSON: The S. B. Foot Tanning Company has had experience with those tannages. Would you like to say something Mr. Benrud?

BENRUD: We have found that after we went to drum tannage we actually had to lower our splitting weights. One of the reasons why we changed to drum tannage was because the paddles were wearing out and we also found that we did not always have a positive action. That is, you did have the trouble of skins laying down. Listening to the discussion this afternoon, I wondered if that point didn't enter into paddle bating and possibly paddle pickling.

CHAIRMAN WILSON: Do you mean laying down in the bottom of the vat and not being picked up?

BENRUD: Yes.

CHAIRMAN WILSON: Let us go back to the final qualities of the leather with respect to some tanning variables. I am being arbitrary but I would like to hear a little bit about any tanning variables.

MR. BARNEY SINGER (Korn Leather Company): Using a basic alum as a pre-tan, would it make any difference on the grain strength, whether the stock has been split? Where you have a lot less area in the unsplit stock, as against the split stock?

CHAIRMAN WILSON: Basic alum?

SINGER: Yes, like that white tan Number 1, of Dr. Turley.

TURLEY: Will you repeat the question, please?

SINGER: On using basic alum like the white tan Number 1, would it make any difference on grain strength whether they used the same percentage on unsplit stock as against split stock?

TURLEY: It does look as if there would be differences on a percentage basis, unsplit and split. You will get a different ratio of penetration there. I don't

see why there should be any difference in grain strength, one way or the other.

It is getting a little complicated. We have just touched on chrome. It will be like last year—we will just about touch on it and have to leave it and then start in possibly next year—which is all right. It will give you people a lot to think about.

I thought you first referred to chrome alum. So we ought to add that to the list in the discussion of two-bath chrome, chrome alum, which really preceded the one-bath chrome. And then go from there to the alum tannage, zirconium and other things, while we are still dealing with mineral tannage.

I just can't say. I am sorry that I cannot think fast enough to visualize what would happen or why there would be any differences with the basic alum put on the split or the unsplit stock. I will have to think it over.

CHAIRMAN WILSON: Suppose we get back to the tanning variables, and again I say I am being arbitrary, but let us take the type of question that Mr. Salamatov threw out earlier today, and discuss this: (this is not a hypothetical question and could very well happen in a tannery)—what is the influence of the tanning temperature on the final leather qualities? Should chrome tanning be done at warm temperatures? Should it be done cold? I am not looking for a "yes" or "no" answer to that question. What I am looking for is the relationship between tanning temperature and the quality of the finished product.

I have a feeling there probably is some connection. Is there anybody experienced enough by a change in process or by experimentation, or applied research of some kind, to shed some light on that subject?

DR. FRED O'FLAHERTY (Tanners' Council Research Laboratory): I regret not having had the opportunity to be with you the balance of the day. As you know skins and hides are containing much more natural grease today, and were it not for the warmer temperatures used during chrome tanning, you would be defeated in obtaining good chrome distribution. Therefore, I would think that as you go from hot to cold tanning temperatures you would find a decreasing chrome take-up and also that you would have more spews on the leather.

CHAIRMAN WILSON: Redistribution of grease?

O'FLAHERTY: Yes, and removal too.

CHAIRMAN WILSON: On the other hand, I have a hunch that warmer temperatures may have had effects on leather quality, too.

O'FLAHERTY: If too high, yes.

MILLER: I think in relation to the matter of temperature and tannage, we discussed temperature in relation to pickling. And when we start at the outset of our chrome tanning we have basically a pickled skin which has the chrome material running through it. It is not tanned at that point. So that it would be susceptible to heat and as the tannage progresses it could stand more heat.

I am sure that the people who have paddle tanned can answer the question better, but in our experience an elevation of the temperature at the end of the tan, if you would bring it up slowly, you would increase the chrome take-up in that skin. And I believe a lot of times that paddle tannages are controlled. The tannage is controlled by controlling the temperature of the bath.

I was wondering whether Mr. Jordan could help us out with an answer to that?

(Mr. Jordan had left)

MILLER: Mr. Riese?

RIESE: We have just completed a series of tests on the effect of temperature in chrome tannage and we found that temperature had a much greater effect on the amount of chrome fixed that we had ever imagined.

We found that if the starting temperature was adjusted to give us an exhaust temperature of 90° we fixed 2.7% $Cr_2O_3$ on the dry basis. At an exhaust temperature of 98° we fixed 3.2% $Cr_2O_3$.

In other words, we fixed almost 18% more $Cr_2O_3$ by raising our tanning temperature 8° without changing the amount of chrome tanning material.

We expected a difference, but not as great a difference as actually occurred.

MILLER: Two questions come to mind: did you carry the experimentation further than 100 degrees? And what were the other effects on the finished leather?

RIESE: The leather came out plumper and gauged heavier. We got a higher shrink temperature and we did find more uniformity from side to side, interestingly enough, at the higher temperature. When we brought it up to 106 or 107—it went up to 3.6 per cent of chromium oxide. What we found was that we could vary any amount of chromium oxide we wanted, depending on what exhaust temperature we used and most practical tanners do know you can regulate your exhaust temperature in more than one way—either by starting pickling temperature or length of the float or speed of milling.

BERNARD: That is drum tannage?

RIESE: Drum tannage, yes.

IVANY: To my knowledge it is a commonly accepted fact that with increase in temperature the basicity of the chrome complex goes up and if that is true, it serves as a perfect explanation for more chrome take-up, fuller leather and so on.

I would like to hear from some of the scientists in the audience as to whether that common belief has been substantiated by controlled experiments.

MILLER: Mr. Benrud, is there something you wanted to say on temperature and tannage?

BENRUD: The original question referred to paddle tannage and we have always found it true that when you go up in temperature, you do get an increased pick-up in chrome and that follows in any tannage. Of course you cannot neglect the effect of neutralization. The higher you neutralize, the more you will pick up chrome.

MILLER: Did you find that it was easier to control the temperature in a paddle than in a drum?

BENRUD: Definitely. There you use a steampipe and any temperature you want, you can just prescribe it and by adding steam to the paddle, you can raise it to any degree. Whereas, to control the temperature in a drum it is a question of the concentration or the load that you have, and the starting temperature, the time, and speed of the drum. These factors and temperatures of solutions added will all change the final temperature at which your stock will come out.

BERNARD: Mention was made in regard to paddle tanning as against drum tanning about the loads tieing up or settling on the bottom. We find there is a very big difference in the speed that the paddle runs—where some paddles run 16 to 18 RPM, we find that our best speed is around 35 to 40 RPM.

We also find the number of blades on the paddle, that will pull the skins up off the bottom, makes a difference; the amount of water in relation to the load; and if the water is too high sometimes it won't turn as well as when it is lower.

We also found in making different tannages with paddle and drum, that in our particular case we got plumper and more solid leather in the paddle. It has taken us longer and it cost more money, but it made plumper, more solid, rounder and better leather. I think it makes a difference whether you work a one-bath tan in a paddle or a two-bath tan in a paddle, also.

Some of the fellows set out in between two-bath and where they might not get as much plumpness, they will get a finer grain by setting out between the first and second bath, and they will get more yield in spite of the fact that it

is a paddle tan, than some of the fellows who are making side leather and run a two-bath method where the leather's second bath is right on top of the first bath.

I think it makes a difference how it is done, in other words, as to what your yield is; whether you get more yield from a two-bath or one-bath or a paddle. I think it makes a difference as to the method used.

CHAIRMAN WILSON: Is there further discussion on the subject of temperature or paddle versus drum? If not, the time is approaching for the end of this meeting, and as we stated in the beginning of our meeting, one of our basic objectives here is to talk over problems among ourselves and at the same time the reason for having it at the ALCA meeting is, of course, to give those who are connected with research at least an inkling of what might be done by both basic and applied research.

And I would like to make that distinction at this time. I think we all have a knowledge of the difference between basic and applied research, and this is my personal opinion: that the balance between the two perhaps is not good enough. I think observing last year's meeting and this year's meeting that perhaps one of the greatest challenges to the plant chemists is that of applied research. The things that we said here today and also last year, I think you will agree with me, were primarily the experiences and judgments and opinions and facts which have come from tanners, themselves, and they learned them, themselves.

May I suggest that the greatest challenge not only to plant chemists, but to ALCA, too, is to substantiate perhaps some of the things that were said here today.

Actually, we should, in applied research, be ahead of the tanner. We should not be twenty years behind him. And of course, in my discussion right now I am talking not about the amount of chrome that was picked up, or the final temperature, or this or that. I think there is a tremendous challenge to technical people in this industry, to put things on paper—not just for their bosses, not just for their management, but in publishable form.

I do not think that it would be too far out of line, for example, for a plant chemist or a plant staff, a laboratory, to publish work which involves some of the things we have talked about here today.

There have been many things suggested—the one we were just talking about, for example, the variable in temperature of chrome tanning and its effect on leather quality, rather than its effect on the chemical properties of the skin.

I think there is much to be desired in the field of applied research as opposed to basic research. Basic research is absolutely necessary and we must have it. But my personal opinion is that the balance for the last, let us say twenty or thirty years, has not been quite right. And I think you will have to agree

with me that that has been illustrated more or less in these three practical meetings that we have had over the last four years.

With that thought I would like to take this opportunity to thank the Council of the ALCA on behalf of the panel members for the opportunity to put on this program. We have had a wonderful time working together, and you would probably be surprised at some of the practical discussions that we, ourselves, have been in, around the table, in preparing this program.

I hope that this program can continue, year after year. We have, I believe, just scratched the surface. And I am sure that it can be made better and bigger and more important than it is today. I believe that it has a definite place at this ALCA meeting.

With that thought I want to thank you all on behalf of the panel for your kind cooperation and we will be looking forward to seeing you next year.

The meeting is adjourned.

MEO (Program Committee Chairman): We have now rung down the curtain on another Convention—and I believe one of the most successful presentations of our everyday work, in the hope that a full participation of the membership into what makes better leather, will raise the standards of the whole industry to the benefit of us all.

I have noticed that there has been a certain reluctance on the part of some to join in and participate in this discussion. We hope that reluctance will have vanished within the next few years. Because it is only with a full scale participation of everyone here that we can close that gap, as Dave so appropriately put it, between basic research and everyday tannery practice.

We need your help. We want to help you. But we also need your participation in all segments of the Society.

I think at this time, to those gallant gentlemen here, who have explored the field and have tried so valiantly to present in as fair a manner as possible all phases of the subjects discussed, a real rising vote of thanks, and to wish them again many, many thanks.

(The members arose and applauded, after which the meeting adjourned at 4:30 p.m.)